

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES
NORTHERN DISTRICT

ALTURAS GROUND WATER BASIN WATER QUALITY STUDY



JANUARY 1986

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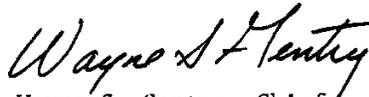
FOREWORD

The principal objective of the investigation leading to this report was to update knowledge of water quality of the Alturas Ground Water Basin in the south-central Modoc County. The basin encompasses an area of about 135 square miles, and contains approximately 7.5 million acre-feet of ground water in storage to a depth of 800 feet.

The basin's quality has been monitored annually since 1959, providing information which was particularly helpful in the planning of this study. Wells have been monitored on a yearly basis to determine natural variation and detect long-term trends.

The additional information developed is essential not only in managing this water resource to maximize its beneficial uses, but also to plan for future conjunctive ground and surface water uses. It should also be useful to help develop more definitive objectives for water quality control plans.

This report includes a brief overview of the study area, its geology, climate, development, and water supply. It describes the hydrologic conditions that prevail, summarizes water quality data, and sets forth findings and conclusions.



Wayne S. Gentry, Chief
Northern District

CONVERSION FACTORS

Quantity	To Convert from Metric Unit	To Customary Unit	Multiply Metric Unit By	To Convert to Metric Unit Multiply Customary Unit By
Length	millimetres (mm)	inches (in)	0.03937	25.4
	centimetres (cm) for snow depth	inches (in)	0.3937	2.54
	metres (m)	feet (ft)	3.2808	0.3048
	kilometres (km)	miles (mi)	0.62139	1.6093
Area	square millimetres (mm ²)	square inches (in ²)	0.00155	645.16
	square metres (m ²)	square feet (ft ²)	10.764	0.092903
	hectares (ha)	acres (ac)	2.4710	0.40469
	square kilometres (km ²)	square miles (mi ²)	0.3861	2.590
Volume	litres (L)	gallons (gal)	0.26417	3.7854
	megalitres	million gallons (10 ⁶ gal)	0.26417	3.7854
	cubic metres (m ³)	cubic feet (ft ³)	35.315	0.028317
	cubic metres (m ³)	cubic yards (yd ³)	1.308	0.76455
	cubic dekametres (dam ³)	acre-feet (ac-ft)	0.8107	1.2335
Flow	cubic metres per second (m ³ /s)	cubic feet per second (ft ³ /s)	35.315	0.028317
	litres per minute (L/min)	gallons per minute (gal/min)	0.26417	3.7854
	litres per day (L/day)	gallons per day (gal/day)	0.26417	3.7854
	megalitres per day (ML/day)	million gallons per day (mgd)	0.26417	3.7854
	cubic dekametres per day (dam ³ /day)	acre-feet per day (ac-ft/day)	0.8107	1.2335
Mass	kilograms (kg)	pounds (lb)	2.2046	0.45359
	megagrams (Mg)	tons (short, 2,000 lb)	1.1023	0.90718
Velocity	metres per second (m/s)	feet per second (ft/s)	3.2808	0.3048
Power	kilowatts (kW)	horsepower (hp)	1.3405	0.746
Pressure	kilopascals (kPa)	pounds per square inch (psi)	0.14505	6.8948
	kilopascals (kPa)	feet head of water	0.33456	2.989
Specific Capacity	litres per minute per metre drawdown	gallons per minute per foot drawdown	0.08052	12.419
Concentration	milligrams per litre (mg/L)	parts per million (ppm)	1.0	1.0
Electrical Conductivity	microsiemens per centimetre (µS/cm)	micromhos per centimetre	1.0	1.0
Temperature	degrees Celsius (°C)	degrees Fahrenheit (°F)	(1.8 × °C) + 32	(°F - 32)/1.8

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INTRODUCTION

The Department of Water Resources conducted an extensive investigation of the ground water basins of northeastern California in the late 1950s. Results were reported in Bulletin 98, "Northeast Counties Ground Water Investigation", February 1963. In conjunction with that investigation, water quality studies were made which provided a good overview of ground waters in the Alturas Basin.

Since then, there has been a large increase in the use of ground water in northeastern California and growing concern over the resultant decline of water levels in wells. The concern for these valuable ground water resources led to a reevaluation of the hydrologic conditions in the northeast counties basins, including Alturas Basin, with results being published in the Northern District report "Northeastern Counties Ground Water Update", 1982.

This water quality study of Alturas Basin was undertaken to provide current information and supplement the hydrologic update. Its objectives were to:

1. Determine the present quality of Alturas Basin ground waters.
2. Evaluate the water quality as it relates to beneficial uses.
3. Detect and evaluate existing water quality problems.

Scope

In the initial phase of the study, historic data were compiled and evaluated. Well logs were reviewed and wells were selected for supplemental sampling to improve areal coverage and better define areas with poor quality water. During the summer of 1982 and spring of 1983, wells were located and samples collected for analysis. At the time of field collection, temperature, pH, and electrical conductivity (EC) measurements were made. Selected samples were then delivered to the Department's chemical laboratory in Bryte for more detailed analysis.

Analyses received from the laboratory were checked and put into the Department's Water Data Information System. Results were used to evaluate the present ground water quality and relate this to the historic quality. Water quality problems were identified by comparing the quality with criteria related to major beneficial uses. Data developed from the Department's ground water quality monitoring program provided information on the change of quality with time.

This report includes a description of the methods used in the investigation, an evaluation of the present ground water quality, a description of water quality problem areas, and information on water quality changes. Findings, conclusions, and recommendations are included. All data developed during this investigation along with historic data are included in the appendices.

Area of Investigation

Alturas Basin is located in the south-central portion of Modoc County, in Northeastern California (Plate 1). The basin is east of the Cascade Mountain Range and on the western side of the Warner Range. It includes two elongated areas or subbasins which meet in the vicinity of Alturas. The eastern subbasin is about 25 miles long in a north-south direction and ranges up to 6 miles in width. This subbasin includes a valley floor area of about 100 square miles. The valley slopes from south to north and drops in elevation from about 4,500 feet to 4,370 feet. The western subbasin, formerly known as the Warm Springs Basin, has an east-west length of 15 miles and is about 8 miles across at its widest point. It has an area of about 34 square miles, and its elevation is about 4,350 feet. It drains from northeast to southwest. The ground water basin, with a total valley floor area of about 134 square miles, has a contributing watershed area of about 1,430 square miles.

Geology

Alturas Basin is located in an area of volcanic and sedimentary rocks of the Modoc Plateau. It is rimmed by highly jointed lava flows of Plio-Pleistocene age. The basin is underlain by poorly permeable, volcanic rocks of Miocene age. The main water-bearing formation in the basin is the Plio-Pleistocene Alturas Formation, mostly comprised of lake-deposited tuff, ashy sandstone, gravel, and diatomite. Its thickness ranges up to 1,450 feet. The formation also includes a basalt member, ranging from 50 to 250 feet thick, and the Warm Springs tuff member, 100 to 400 feet thick. Recent valley sedimentary deposits of clay, silt, and fine sand, 0 to 50 feet thick (see Figure 1), overlie the Alturas Formation.

Climate

The Alturas Basin's climate can be classified as semi-arid. It has cold, wet winters and warm, dry summers. The major factors affecting the climate of northeastern California are being over 150 miles inland and the orographic rainfall pattern of California.

Moisture-laden air moves into California in an easterly direction. As the air rises over and crosses the Coast Ranges, it loses much of its moisture. Moisture is further removed from the air masses as they continue eastward across the Cascade Ranges and finally the Warner Mountain Range. It is this last bit of precipitation over the windward (western) face of the Warners that supplies the Alturas Basin with water, via runoff and snowmelt from streams draining out of the Warners into the Alturas Basin.

Approximately 70 percent of the total precipitation that the Alturas Basin receives occurs between October and March. Much of this is in the form of snow. Heaviest precipitation occurs in December, with a mean monthly accumulation of 1.6 inches. The driest month is July, with a mean monthly accumulation of 0.3 inches. Mean annual Alturas Basin precipitation is about 13.4 inches.

Alturas basin generally has cold winters and warm summers. The coldest mean monthly temperature for the Alturas area is 28.6 degrees F, occurring in January. The average daily maximum temperature in January is about 40 degrees F. The warmest mean monthly temperature occurs in July;

Figure 1

GEOLOGIC FORMATIONS IN ALTURAS BASIN						
GEOLOGIC AGE	GEOLOGIC FORMATION	STRATIGRAPHY	APPROXIMATE THICKNESS IN FEET	PHYSICAL CHARACTERISTICS	WATER-BEARING CHARACTERISTICS	
QUATERNARY	RECENT	TALUS	Qta	0-75	Qta: Unconsolidated blocks of rock. Of small areal extent.	Highly permeable, but usually above zone of saturation. Yields water to springs.
		MUCK AND PEAT	Qmp	0-50		
		BASIN DEPOSITS	Qb	0-50		
		INTERMEDIATE ALLUVIUM	Qel	0-75	Qel: Unconsolidated deposits of organic muck and fibrous peat. Found only in Jess Valley.	Very low permeability. Unimportant as source of ground water.
		ALLUVIAL FANS	Qaf	0-75		
	PLEISTOCENE	LANDSLIDE	Qls	50-100		
		PLEISTOCENE BASALT	Qpb	50-150	Qb: Unconsolidated, interstratified clay, silt, and fine sand.	Permeability moderate to slight. May yield small supplies of water to wells.
		PYROCLASTIC ROCKS	Qpvb	?		
		NEAR-SHORE DEPOSITS	Qps	0-200	Qal: Unconsolidated, poorly sorted silt and sand with some lenses of gravel.	Moderately permeable. Yields moderate quantities of water to shallow wells.
	PLIO-PLEISTOCENE	UPPER MEMBER, ALTURAS FORMATION	TQa	400	Qf: Unconsolidated to poorly consolidated, rudely stratified sand, silt, and gravel, with lenses of clay. Qla: Semiconsolidated mixture of blocks of basalt in matrix of clay and sand.	High permeability. May yield large quantities of water to wells; may contain confined water. Of low permeability and of little importance to ground water.
			TQvb	50-250	Qpvb: Highly jointed, flat-lying olivine basalt flows with interbedded scoriaceous zones.	Unit as a whole moderately permeable. Acts as forebay for recharge to adjacent sediments.
		WARM SPRINGS TUFF MEMBER	TQvt	100-400	Qvvp: Semiconsolidated red and black cinders.	Moderately permeable but contains little water due to being above saturated zone.
		LOWER MEMBER, ALTURAS FORMATION	TQc	400	Qst: Slightly consolidated and cemented, poorly to well stratified pebbles and cobble gravel with lenses of sand and silt. TQc: Lake deposited tuff, ashy sandstone, gravel, and diatomite. Indistinguishable from lower member.	Of moderate permeability. May yield fair to moderate quantities of water to wells. Moderate to high permeability. Yields large quantities of water to wells. Contains confined water.
	PLEISTOCENE		ANDESITE	Tpva	?	
		BASALT	Tpvb	?	TQvb: Jointed, nearly flat-lying flows of basalt with zones of scoria.	Unit as a whole is moderately permeable. Yields water to numerous springs. Acts as forebay for recharge to adjacent sediments. May yield moderate amounts of water to wells.
RHYOLITE		Tpvc	?			
TERTIARY	MIOCENE VOLCANIC ROCKS	BASALT	Tmvb	300	TQvt: Massive pumice lapilli tuff, jointed beds of welded tuff, minor beds of ashy sandstone.	Transmits small quantities of water along joints and fractures. Sandstone beds may yield moderate quantities of water.
		PYROCLASTIC ROCKS	Tmvp	1000	TQa: Indistinguishable from upper member. May be Miocene in part. Tpvb: Flugs of massive and platy andesite.	Same as upper member. Essentially impermeable.
	TURNER CREEK FORMATION	Tpvb	4000	Tpvb: Jointed, dipping flows of basalt. Trr: Massive, light-colored plugs of rhyolite.	Fair to poor overall permeability. Locally yields small amounts of water to springs. Essentially impermeable.	
		Tmvb	4000	Tmvb: Flows of jointed vesicular basalt.	Transmits only minor quantities of water along joints.	
		Tmvp	4000	Tmvp: Bedded mudflows, tuffs, ashy sandstone, and diatomite. May be correlative to Turner Creek formation. Upper portion may grade into lower member of Alturas formation.	Of low overall permeability. A few permeable beds may yield limited quantities of ground water to wells.	
		Tmtc	4000	Tmtc: Massive mudflows and tuffs with beds of ashy sandstone and diatomite. Upper portion may be correlative to lower member of Alturas formation.	Of low overall permeability. A few permeable beds may yield limited quantities of ground water to wells.	
		Tmc	7500	Tmc: Massive tuff breccia, basalt, and andesite.	Nearly impermeable. May yield small amounts of water from fractures and joints.	
		JEDARVILLE SERIES	Tmc	7500		

it is 66.2 degrees F. July's average daily maximum is 88.2 degrees F, and its average daily minimum is about 44 degrees F.

Development

Though a few brave pioneers settled in the area as early as 1846, the fierce Modoc Indians discouraged most settlement until after the close of the Modoc Indian Wars, in 1873. The grasslands along the Pit River, including the Alturas Basin, were especially attractive for cattle raising. Most development took place where water could be diverted from the Pit River or tributary streams and used to expand the natural pastures to increase production.

Secondary activity in the basin includes wood processing in Alturas. It is also a tourist stop, as U. S. Highways 299 and 395 intersect there. The Southern Pacific Railroad serves the area's lumber mills. However, livestock are more frequently sent to market by truck than by rail.

A population of 3,000 is supported in the Alturas area, which is the service and supply center for most of the basin's population. Two other small communities are situated in Alturas Basin; Canby in the western end, and Likely in the southern end of the basin.

Water Supply

Most of the water supply for the Alturas Basin originates as snowmelt and most of the runoff occurs from March through July, while water demands are greatest from May through September. Water shortages occurring in July, August, and September posed problems for early settlers, and numerous reservoirs were built to provide water in the summer and fall. These include West Valley, Pine Creek, Payne, French, Dorris, and Dannhauser Reservoirs, to name a few. Even with reservoir storage, competition for the limited supply of surface water resulted in conflicts over water rights, and during the 1930s rights to portions of the Pit River and many of its tributaries were defined in court decrees.

Department of Water Resources land-use surveys found that in 1955 about 44,000 acres were irrigated in Alturas Basin and that by 1979 about 53,000 acres were being irrigated. About 4,400 acre-feet of the 1979 irrigation requirement was met by pumped ground water. Much of the increase in irrigated lands was made possible by improved irrigation practices rather than development of new water supplies. As little unappropriated surface water remains, additional water demands will probably be met by more efficient use of water and additional use of ground water.

Waste Discharges

In the Alturas Basin major point source waste discharges have been limited to lumber mill wastes and domestic wastes from the City of Alturas. Additional domestic wastes are discharged through cesspools or septic tanks and leach fields in unsewered communities and at scattered locations over the watershed. As populations have remained low historically, domestic wastes have probably had limited impact on the mineral quality of the waters.

Nonpoint sources associated with agriculture (fertilizers, barnyard effluent, return irrigation flows, etc.) have probably had a greater impact on the water resources than point sources.

HYDROLOGY

The hydrology of the Alturas basin is affected by the diverse areal and seasonal distribution of precipitation, by large seasonal temperature variations, the influence of snowpack, the geologic and geographic features, and the use of surface and ground waters.

Precipitation

Although the mean annual precipitation along the crest of the Warner Mountains approaches 35 inches, the mean annual precipitation in the vicinity of Alturas is only about 13.4 inches and the basin is considered to be semi-arid. Most of the precipitation occurs between late fall and early spring and is stored as snowpack until the late spring thaw. There is generally a high runoff in spring and early summer when warmer temperatures melt the snow pack.

Surface Water

Numerous small streams drain the western slopes of the Warner Mountains and carry their annual water crop to the Pit River Valley. Water not diverted from these streams flows into the South or North Forks of the Pit River which converge near Alturas to form the Pit River. From there the Pit River flows westerly past Canby to Big Valley. The mean seasonal natural runoff in the Pit River near Canby at the lower end of the Alturas Basin has been estimated to be about 238,000 acre-feet.

The Pit River and its tributaries not only provide about 143,000 acre-feet annually for agricultural use, but also contribute significantly to the recharge of Alturas ground water basin.

Ground Water

The total ground water storage capacity in the Alturas Ground Water Basin to a depth of 800 feet has been estimated to be about 7,500,000 acre-feet. It is not presently known, however, how much of this quantity is usable or how much usable storage exists below 800 feet. The basin is divided into South Fork Pit River Subbasin and Warm Springs Valley Subbasin.

Occurrence

The principal water-bearing formations in Alturas Basin are Plio-Pleistocene and Pleistocene lava flows, the Alturas Formation, near-shore lake deposits, and Recent valley sedimentary deposits (see Figure 1). The Plio-Pleistocene lava flows, which are most prominent in the peripheral areas of the basin, are moderately permeable and, where exposed, provide an important recharge area.

The Alturas Formation is widespread and is the principal water-yielding formation in the basin. The sedimentary and volcanic rocks of this

formation have moderate to high permeability and, where saturated, yield sufficient ground water to wells for irrigation use. The formation contains both confined and unconfined ground water.

Extensive near-shore deposits occur on the east side of North Fork Pit River Valley. Minor areas of these deposits are also found locally at other locations in the basin. Although few wells have been drilled in these deposits, they appear to have moderate permeability.

Recent valley sedimentary deposits, which include alluvial fans, intermediate alluvium and basin deposits, are usually thin, being less than 50 feet thick. The alluvial fans are very permeable and usually provide high yields of confined and semiconfined water to wells. The intermediate alluvium has a somewhat lower permeability, but can provide moderate amounts of ground water to wells. Basin deposits with their very low permeability yield only small amounts of water.

Movement

Ground water movement in the basin generally follows the topography with water moving from the upland recharge areas that ring the valley down to the valley floor. Ground water in the South Fork Pit River Subbasin moves in a northerly direction towards Alturas. South of County Road 170 there is considerable recharge from irrigation water. From Alturas the ground water moves westerly into Warm Springs Valley Subbasin. In Warm Springs Valley, ground water migrates from the north, east, and south, then westerly along with the Pit River.

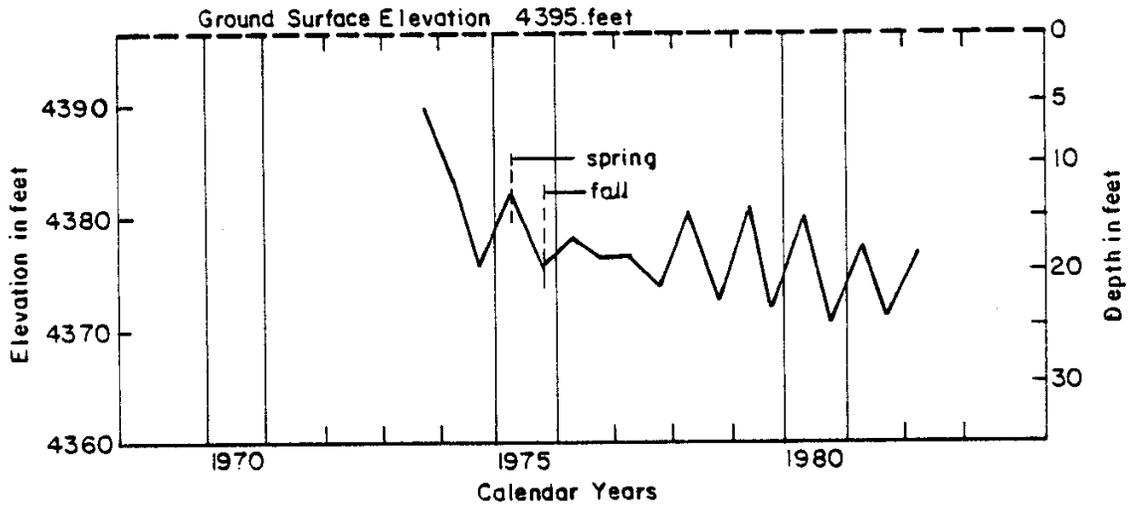
Levels

Ground water level measurements in wells show that ground water depths are usually less than 50 feet below the ground surface in the valley floor area. About half the measurements made in 1983 show the water table to be less than 25 feet below ground surface.

There has been a recent decline in ground water levels in some localized areas. Northeast of Alturas, levels dropped about five feet between 1975 and 1982 (see Figures 2, 3, and 4). Except in localized areas, spring water level measurements indicate little or no change in water levels.

Limited historic water level and pumpage data make it difficult to evaluate recent water table fluctuation or the lowering of the water table northeast of Alturas. Increased ground water pumpage and/or below normal recharge may be responsible for the lowering water levels. With increased ground water use, greater water level fluctuation should be expected with more movement of water into the areas of pumpage.

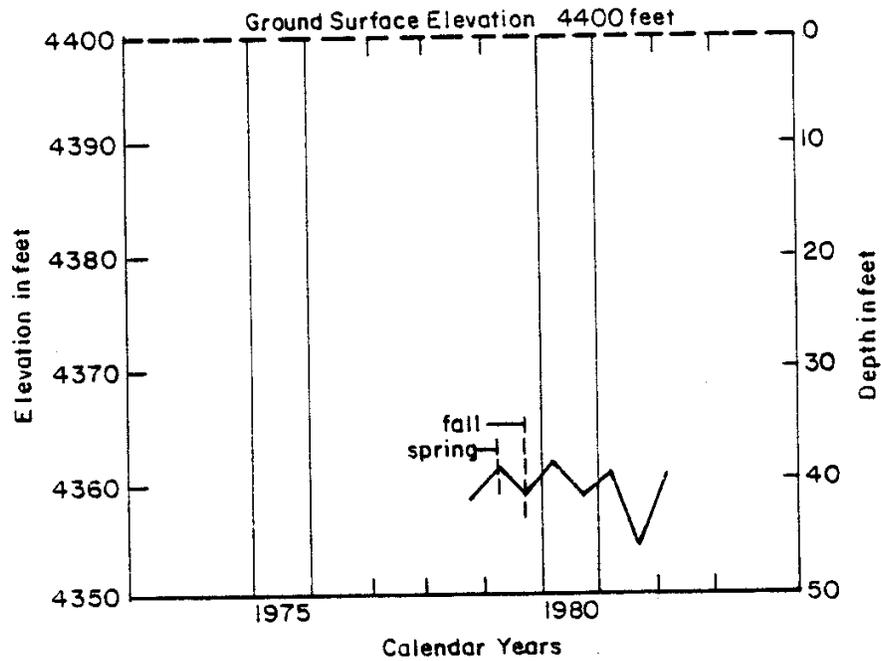
Figure 2



Well Number 42N/13E-6P2
Well Depth 270 feet
Well Use Irrigation
Location Approximately 1.5 miles NE of
junction Highway 299 and 395,
1000 feet south of Highway 395
in field.

Elevation changes in measured Well 6P2 Alturas

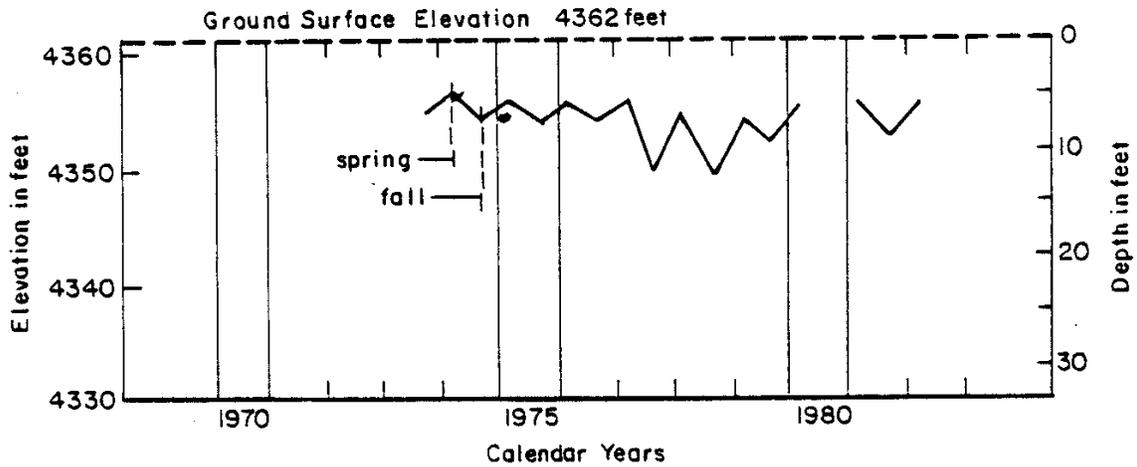
Figure 3



Well Number 41N/12E-15Q1
Well Depth 300 feet
Well Use Irrigation
Location South of Alturas County Road 60
3.5 Miles; Well is west of road 2640 feet.

Elevation changes in measured Well 15Q1 Alturas

Figure 4



Well Number 42N/13E-3IP2
Well Depth 400 feet
Well Use Irrigation
Location Approximately 3 miles SE
of Alturas.
Well is 1200 feet west
of County Road 59A

Elevation changes in measured Well 3IP2 Alturas

WATER QUALITY

To determine the present quality of the Alturas Basin ground waters, sampling surveys were conducted in the summer of 1982 and spring of 1983. The Department of Water Resources' regular monitoring program wells were included so that present quality could be evaluated in relation to historic variation. The following sections present information on the water quality parameters, sampling and analytical procedures, and water quality criteria.

Water Quality Parameters

The suitability of ground water for beneficial use can be determined by its quality, which can be derived from a study of its chemical and physical characteristics.

Chemical

Precipitation, as it reaches the earth, is an excellent solvent. It contains dissolved gasses, such as carbon dioxide and oxygen, but normally contains few dissolved solids. As water passes through the hydrologic cycle, either on the surface or through the ground, it dissolves minerals from the materials it contacts. The amount and type of minerals dissolved reflect the composition of these materials and the hydrologic conditions governing the rate of water movement. Often, more salts and pollutants may be added by sewage, industrial wastes, and irrigation return flows. These dissolved substances can determine water's suitability for various beneficial uses.

A measure of the overall chemical quality can be obtained by determining and summing the concentrations of individual ions in a water. A measure of the total dissolved solids (TDS) can also be obtained by filtering a water sample, drying it, and weighing the residue. A third technique measures the electrical conductivity (EC) of the water sample, as that value can be related to the ionic content of the water. Ions commonly found in natural waters and most often looked for in laboratory analysis include calcium, magnesium, sodium, potassium, bicarbonate, carbonate, sulfate, chloride, and boron. Each of these is important to one or more beneficial uses.

Another important chemical factor is pH, which is a measure of the water's acidity (hydrogen ion content). The pH scale ranges from 0 to 14, with a value of 7 being neutral. Most natural waters have a pH in the 6.5 to 8.5 range, while an acid, such as lemon juice, has a pH of about 2, and household ammonia has a pH of about 12.

Alkalinity is a measure of a water's ability to withstand changes in pH and is due to the carbon dioxide, bicarbonate, and carbonate equilibrium in the water. The buffering action of this equilibrium is important because it dampens pH fluctuations that might occur due to waste discharges or intense algal growth. It also serves as a source of inorganic carbon for plant growth.

Water contains varying amounts of certain elements which are essential to biologic productivity and are referred to as nutrients. Such metals as iron, copper, molybdenum, etc., are needed in trace amounts and are called

micronutrients. Carbon, nitrogen, and phosphorus are needed in larger quantities and are referred to as macronutrients. The two elements most often considered limiting to primary productivity in aquatic systems (if there were more of that element present, there would be more growth) are nitrogen and phosphorus.

Nitrogen is found in water in the form of nitrate, nitrite, and ammonium ions, ammonia gas, or as part of nitrogen-bearing organic compounds. Nitrate is the form most commonly found in ground water.

Phosphorus is found in water as orthophosphates, polyphosphates, and organic phosphorus. Most forms are converted in nature to orthophosphates by bacterial action or hydrolysis, and this is the form used by organisms. Both orthophosphate and total phosphorus levels are generally included in nutrient determinations.

Physical

Temperature, color, and odor are important physical characteristics of water. Temperature greatly influences the suitability of water for many beneficial uses. It affects the solubility of gases, and other substances in water, water density, and its viscosity. Color and odor characteristics affect the potability of water and are important to its domestic use.

Sampling and Analytical Methods

Ground water samples were collected during this study in sample-rinsed plastic bottles. Samples were collected from taps at the wells or from the nearest possible point in the distribution systems. Whenever possible, samples were collected from systems when pumps had been operating for a period of time so that its quality would represent the well's source aquifer. Temperature, pH, and EC measurements were made at the time of sampling, and additional samples were collected for analyses at the Department's chemical laboratory in Bryte.

Temperatures were measured with standard field thermometers whose calibrations had been checked in the laboratory.

Field pH was determined by using Hellige Comparitors with appropriate indicator solution and disk. Laboratory pH's were also measured in selected samples with a calibrated glass electrode-type pH meter.

Electrical conductivity was measured on portable Beckman solubridges that had been calibrated on known solutions. Selected samples that were sent to the laboratory also had EC determinations made for quality control.

Samples collected for standard mineral or special constituent determinations were transported to the Bryte Laboratory for analysis. Table 1 lists the standard methods used at that laboratory.

Trace metal samples were collected in special acid-rinsed plastic bottles. Double distilled nitric acid was added to reduce the pH to 3 and samples were transported to the laboratory.

TABLE 1
ANALYTICAL METHODS
FOR WATER QUALITY PARAMETERS

<u>Parameter</u>	<u>Method</u>
Electrical Conductivity	Beckman Wheatstone Bridge
Total Hardness	Ca, Mg Atomic Absorption Spectrophotometric
Sodium	Atomic Absorption Spectrophotometric
Potassium	Atomic Absorption Spectrophotometric
Sulfate	Gravimetric - AWWA
Chloride	Automated Ferricyanate Method
Boron	Carminic - AWWA
Arsenic	Silver Diethyl - AWWA
Barium	Atomic Absorption Spectrophotometric
Cadmium	Atomic Absorption Spectrophotometric
Chromate	Atomic Absorption Spectrophotometric
Copper	Atomic Absorption Spectrophotometric
Iron	Atomic Absorption Spectrophotometric
Lead	Atomic Absorption Spectrophotometric
Manganese	Atomic Absorption Spectrophotometric
Zinc	Atomic Absorption Spectrophotometric
Mercury	Cold Vapor Atomic Absorption - EPA
Dissolved Nitrate	Automated Cadmium Reduction
Total Ammonia	Automated Phenate
Total Organic Nitrogen	Block Digestor Phenate
Dissolved Phosphate	Automated Ascorbic Acid
Total Phosphate	Block Digestor Ascorbic Acid

Water Quality Criteria

As the two major beneficial uses of ground water in this basin are domestic and agriculture, water quality criteria for each were used in the water quality evaluations. Sanitary surveys and bacteriological sampling were beyond the scope of this investigation and evaluations were based solely on chemical and physical characteristics.

Criteria presented in the following sections have been utilized in the evaluations. Except for the constituents that are considered toxic to humans, the concentrations included in the criteria should be considered as suggested limiting values. A water that contains constituent concentrations exceeding these values need not be eliminated from consideration as a source of supply, but should be used with caution and other sources of better quality water should be investigated.

Domestic and Municipal Water Supply

The criteria used in this report for evaluating ground water for domestic use are those included in the State of California domestic water regulations for chemical and physical quality.

Water containing contaminants exceeding the maximum contaminant levels shown in Tables 2, 3, and 4 presents a risk to the health of humans when continually used for drinking or culinary purposes.

TABLE 2

MAXIMUM CONTAMINANT LEVELS
INORGANIC CHEMICALS

<u>Constituent</u>	<u>Maximum Contaminant Level, mg/L</u>
Arsenic	0.05
Barium	1.
Cadmium	0.010
Chromium	0.05
Lead	0.05
Mercury	0.002
Nitrate (as NO ₃)	45.
Selenium	0.01
Silver	0.05

TABLE 3

MAXIMUM CONTAMINANT LEVELS
ORGANIC CHEMICALS

<u>Constituent</u>	<u>Maximum Contaminant Level, mg/L</u>
(a) Chlorinated Hydrocarbons	
Endrin	0.0002
Lindane	0.004
Methoxychlor	0.1
Toxaphene	0.005
(b) Chlorophenoxys	
2, 4 - D	0.1
2,4,5 - TP Silvex	0.01

TABLE 4

LIMITING CONCENTRATIONS FOR FLUORIDE

<u>Annual Average of Maximum Daily Air Temperature</u>		<u>Fluoride Concentration, mg/L</u>			
<u>Degrees Fahrenheit</u>	<u>Degrees Celsius</u>	<u>Lower</u>	<u>Optimum</u>	<u>Upper</u>	<u>Maximum Contaminant Level</u>
53.7 and below	12.0 and below	0.9	1.2	1.7	2.4
53.8 to 58.3	12.1 to 14.6	0.8	1.1	1.5	2.2
58.4 to 63.8	14.7 to 17.6	0.8	1.0	1.3	2.0
63.9 to 70.6	17.7 to 21.4	0.7	0.9	1.2	1.8
70.7 to 79.2	21.5 to 26.2	0.7	0.8	1.0	1.6
79.3 to 90.5	26.3 to 32.5	0.6	0.7	0.8	1.4

Water containing substances exceeding the maximum contaminant levels shown in Tables 5 and 6 may be objectionable to an appreciable number of people, but is not generally hazardous to health.

TABLE 5

CONSUMER ACCEPTANCE LIMITS
SECONDARY DRINKING WATER STANDARDS

<u>Constituents</u>	<u>Maximum Contaminant Levels</u>
Color	15 Units
Copper	1.0 mg/L
Corrosivity	Relatively low
Iron	0.3 mg/L
Manganese	0.05 mg/L
Odor - Threshold	3 units
Foaming Agents (MBAS)	0.5 mg/L
Turbidity	5 units
Zinc	5.0 mg/L

TABLE 6

MINERALIZATION
SECONDARY DRINKING WATER STANDARDS

<u>Constituent, Units</u>	<u>Maximum Contaminant Levels</u>		
	<u>Recommended</u>	<u>Upper</u>	<u>Short Term</u>
Total Dissolved Solids, mg/L	500	1,000	1,500
or			
Specific Conductance, micromhos	900	1,600	2,200
Chloride, mg/L	250	500	600
Sulfate, mg/L	250	500	600

Water Quality for Agriculture

Prior to 1974, the Department of Water Resources used water quality criteria for the suitability of water for irrigation, which had been developed by the University of California, and classified waters into three groups: Class I (excellent to good), Class II (good to injurious) and Class III (injurious to unsatisfactory). As these criteria were used, it became apparent that they were too general and not applicable in some instances.

To provide improved criteria, a University of California Committee of Consultants formulated a group of guidelines for the interpretation of water quality for agriculture in the early 1970s. These 1970 guidelines have been used by the Department of Water Resources since that time and were used during this investigation. These guidelines are summarized in Table 7 and the complete guidelines are presented in Appendix A.

Guidelines for Interpretation of Quality of Water for Irrigation

Interpretations are based on possible effects of constituents on crops and/or soils. Guidelines are flexible and should be modified when warranted by local experience or special conditions of crop, soil, and method of irrigation.

TABLE 7

<u>PROBLEMS AND RELATED CONSTITUENT</u>	<u>WATER QUALITY GUIDELINES</u>		
	<u>No Problem</u>	<u>Increasing Problems</u>	<u>Severe Problems</u>
<u>Salinity^{1/}</u>			
EC _w of irrigation water, in millimhos/cm	<0.75	0.75-3.0	>3.0
<u>Permeability</u>			
EC _w of irrigation water, in mmho/cm	>0.5	<0.5	<0.2
adj.SAR _{2/}	<6.0	6.0-9.0	>9.0
<u>Specific Ion Toxicity^{3/}</u>			
<u>from ROOT absorption</u>			
Sodium (evaluate by adj.SAR)	<3	3.0-9.0	>9.0
Chloride (me/L)	<4	4.0-10	>10
(mg/L or ppm)	<142	142-355	>355
Boron (mg/L or ppm)	<0.5	0.5-2.0	2.0-10.0
<u>from FOLIAR absorption^{4/} (sprinklers)</u>			
Sodium (me/L)	<3.0	>3.0	--
(mg/L or ppm)	<69	>69	--
Chloride (me/L)	<3.0	>3.0	--
(mg/L or ppm)	<106	>106	--
<u>Miscellaneous^{5/}</u>			
NH ₄ -N mg/L	<5	5-30	>30
No ₃ -N ppm			
} or for sensitive crops			
HCO ₃ (me/L)	<1.5	1.5-8.5	>8.5
(mg/L (only with overhead sprinklers)	<90	90-520	>520
or			
ppm)			
pH	normal range = 6.5-8.4 --		

- 1/ Assumes water for crop plus needed water for leaching requirement (LR) will be applied. Crops vary in tolerance to salinity. Refer to tables for crop tolerance and LR. (mmho/cmX640 = approximate total dissolved solids (TDS) in mg/L or ppm; mmhoX1000 = micromhos).
- 2 adj.SAR (Adjusted Sodium Adsorption Ratio) is calculated from a modified equation developed by U. S. Salinity Laboratory to include added effects of precipitation or dissolution of calcium in soils and related to CO₃ + HCO₃ concentrations.

To evaluate sodium (permeability) hazard:

$$\frac{\text{Na}}{\sqrt{\frac{\text{Ca} + \text{Mg}}{2}}} [1 + (8.4 \text{ pHc})]$$

pHc is a calculated value based on total cations. Ca + Mg, and CO₃ + HCO₃. Calculating and reporting will be done by reporting laboratory.

NOTE: NA, CA+MG, CO₃+HCO₃ should be in me/L.

Permeability problems, related to low LC or high adj.SAR of water, can be reduced if necessary by adding gypsum. Usual application rate per acre-foot of applied water is from 200 to about 1,000 lbs. (234 lbs of 100% gypsum added to 1 acre-foot of water will supply 1 me/L of calcium and raise the EC_w about 0.1 mmho.) In many cases a soil application may be needed.

- 3/ Most tree crops and woody ornamentals are sensitive to sodium and chloride (use values shown). Most annual crops are not sensitive (use salinity tolerance tables). For boron sensitivity, refer to boron tolerance tables.
- 4/ Leaf areas wet by sprinklers (rotating heads) may show a leaf burn due to sodium or chloride absorption under low humidity, high-evaporation conditions. (Evaporation increases ion concentration in water films on leaves between rotations of sprinkler heads.)
- 5/ Excess N may affect production or quality of certain crops, e.g. sugar beets, citrus, avocados, apricots, grapes, etc. (1 mg/L NO₃-N = 2.72 lbs, N/acre-foot of applied water.) HCO₃ with overhead and sprinkler irrigation may cause a white carbonate deposit to form on fruit and leaves.

<u>Symbol</u>	<u>Name</u>	<u>Symbol</u>	<u>Name</u>	<u>Equiv. Wt.</u>
EC _w	Electrical Conductivity of water	Na	Sodium	23.00
mmho/cm	millimho per centimeter	Ca	Calcium	20.04
<	less than	Mg	Magnesium	12.16
>	more than	CO ₃	Carbonate	30.00
mg/L	milligrams per liter	HCO ₃	Bicarbonate	61.00
ppm	parts per million	NO ₃ -N	Nitrate-nitrogen	14.00
LR	Leaching Requirement	Cl	Chloride	35.45
me/L	milliequivalents per liter			
TDS	Total Dissolved Solids			17.1 ppm = 1 grain per gallon

STUDY RESULTS

During this study Alturas Basin's current well and ground water quality data were combined with historic data to get a better understanding of the present ground water quality and detect changes that may have occurred. Well data used in this study are presented in Appendix B. Both current and historic water quality data have been included in Appendices C and D. Each well has been numbered according to the California State Well Numbering System and data in the appendices are listed by that number. All data have also been entered in the Department of Water Resources' data storage and retrieval system (WDIS) so that it is available for dissemination and updating.

The well numbering system uses the township, range, and section subdivisions of the Public Land Survey as its base. Each section is then divided into sixteen 40 acre tracts, lettered as follows:

D	C	B	A
E	F	G	H
M	L	K	J
N	P	Q	R

Well Number
16N/3E-17K1M

Wells are numbered within each 40-acre tract according to the chronological sequence in which they have been assigned California State well numbers. For example, a well which has the number 16N/3E-17K1M would be in Township 16 North, Range 3 East, Section 17 of the Mount Diablo (M) Base and Meridian. K1 further designates it as the first well assigned a State well number in Tract K. The location of the wells utilized in this study are shown on Plate 1.

Water Quality Characteristics

Alturas Basin ground waters are generally of good mineral quality with total dissolved solids (TDS) contents ranging from about 100 to 1600 milligrams per litre (mg/L). Analyses indicate that the well waters have a median TDS concentration of about 260 mg/L and that few wells have concentrations exceeding 500 mg/L. Electrical Conductivity (EC) of 141 well waters ranged from 76 to 2400 micromhos per centimetre at 25 degrees C ($\mu\text{mhos/cm}$) with a median of 315 $\mu\text{mhos/cm}$. The EC measurements show higher concentrations in the central portions of the basin, and are probably related to the lake deposits of the Alturas Formation and the structural systems that formed the basin. EC's in the fringe areas and recharge areas of the basin are low, reflecting the excellent quality of the recharge water. The EC contours (Plate 2) generally follow the surface topography as do the ground water contours.

A comparison of historic and recent EC records showed no discernible trend of change in the basin. Most well waters showed little or no change. Four wells produced water with increased levels of EC during the current sampling while three others showed decreased levels. These changes are in the range of those that should be expected in a basin such as this, with seasonally fluctuating water levels that have been lowered by increased pumping.

The ground waters of this basin are generally sodium bicarbonate in character. In the northeast portion of the basin near Alturas and in the western end of the basin near Canby, well waters are found with higher levels of calcium and magnesium. Most of the well waters are strongly bicarbonate in character, but eight wells produce water that is sodium sulfate in character.

Chlorides

Throughout the basin, chloride levels in the ground waters are generally low. Concentrations in waters from seventy wells ranged from 0 to 271 mg/L with a median of only 8 mg/L. Chlorides only exceeded 50 mg/L in eight wells and most of these are known to draw water from the lake sediments of the Alturas Formation.

Sulfates

Sulfate concentrations are quite variable in the ground waters of Alturas Basin. Analysis of waters from over 90 wells show a range of 0 to 626 mg/L with a median concentration of 16 mg/L. As shown by the median value of 16 mg/L, most of the well waters contain low levels of sulfates; however, twelve wells waters contained concentrations exceeding 100 mg/L, with four of these exceeded 250 mg/L. Most of the wells producing sulfate waters are located in the southwestern portion of the basin between Alturas and Canby and obtain water from the Alturas Formation.

Alkalinity and pH

Alkalinity levels in Alturas Basin ground waters, when expressed as calcium carbonate, ranged from 37 to 487 mg/L, while pH values ranged from 7.0 to 8.5. These levels are within the expected range for good quality bicarbonate type waters and should provide good buffering against sudden pH impacts.

Hardness

Alturas Basin well waters range in hardness from 2 to 506 mg/L (expressed as calcium carbonate) with a median of 76 mg/L. Most of these waters are considered soft; however, in the northeast portion of the basin, near Alturas, there is an extensive area of hard water. There are six wells scattered throughout the basin that produce very hard water with hardness exceeding 300 mg/L. These all obtain water from the Alturas Formation and are located along known or suspected geologic faults.

Sodium Adsorption Ratio

The Adjusted Sodium Adsorption Ratio, (ASAR), is a useful factor in evaluating the hazard related to changes in permeability and resultant salt build up caused by high concentrations of sodium. Levels above 3 can cause increasing problems and levels greater than 9 can cause severe problems. The ASAR values for Alturas Basin well waters ranged from 0 to 23.9 with a median value of 2.3. Ten wells of 118 had ASAR values exceeding 9. These wells obtain water from the Alturas Formation generally in areas where it is a confined aquifer and in the vicinity of known or suspected geologic faults.

Boron

Boron (B) appears to pose no widespread problems in the overall condition of the Alturas Basin's ground water. However, four wells produce waters with boron concentrations exceeding 2 mg/L. Three of them are closely spaced in the same geologic formation, the Alturas Formation (confined). Nearby wells in different formations and others in the same formation (Alturas) do not have high levels of boron. The low boron concentration in the basin ground water is 0.0 mg/L, the median level is 0.03 mg/L, and the high is 4.6 mg/L.

There appears to be no real trend of change in the Alturas Basin's general boron levels, from a comparison of historic and current data.

Nitrates

Nitrate (NO₃) levels in the well waters of Alturas Basin are generally low. Isolated incidences of high NO₃ have occurred, but are not connected spatially or chronologically. Of 16 wells recently monitored for NO₃, none exceeded recommended limits (45 mg/L as NO₃). They ranged in value from 0 to 38 mg/L, with a median value of 4.2 mg/L (16 wells).

Historic data revealed two wells producing water with nitrate concentrations exceeding 45 mg/L. A concentration of 310 mg/L was found in water from well 41N/11E-5L1, while water from 41N/12E-2N1 contained 80 mg/L. These were isolated occurrences apparently caused by local impairment, and do not reflect the general ground water conditions in the Alturas Basin.

Suitability for Beneficial Use

Though the general ground water quality of Alturas Basin is good, there are some localized problems that are limiting water's beneficial uses. Most of these poorer quality waters are from wells that draw from confined portions of the Alturas Formation, and/or from water migrating along faults. Water quality problems associated with these waters include high EC, ASAR, sulphate, boron, and, in one case, chloride. These limit domestic and irrigation uses. Plate 1 shows the well locations and suitability of well water for beneficial use. Plate 2 shows a map of EC contours for the basin.

Domestic

Eight wells in Alturas Basin have produced poor quality water with concentrations of dissolved solids exceeding the recommended levels for domestic use (see Plate 1). Water from well 41N/11E-3E1 also contains concentrations of sulfate and chloride that exceed recommended levels for domestic use. Wells 41N/10E-11B1 and 41N/11E-4J1 produced waters with sulfate concentrations exceeding recommended levels. Although these wells are in scattered locations throughout the basin, they each obtain ground water from the upper Alturas Formation in the vicinity of known or suspected fault zones.

Irrigation

Of the eight wells which produce water not meeting drinking water standards, seven yield water having ASAR values exceeding nine, which indicates that their use for irrigation could cause severe problems. Four additional well waters had excessive ASAR values and these wells are also shown on Plate 1. Water from wells 42N/10E-29A1, 42N/12E-23N1, 42N/12E-26P1, and 42N/13E-31P2 not only have excessive ASAR values, but contain boron concentrations exceeding 2 mg/L, which indicates they can be damaging to most crops. Each of these wells also draws water from the upper Alturas Formation in the vicinity of known or suspected fault zones.

FINDINGS

The most significant findings about water in the Alturas Basin are:

1. The surface water resources of the Alturas Basin are not sufficient to last through the entire irrigation season.
2. The ground water resources of the Alturas Basin must be relied upon to supplement the surface supply from July through September.
3. Pumpage of ground water in the Alturas Basin in 1979 was about 4,400 acre-feet.
4. Most recharge occurs in the upland recharge areas of Devils Garden, Portuguese Ridge, and the western slope of the Warner Mountains.
5. Secondary recharge occurs from the Pit River and other streams tributary to the basin.
6. The direction of the movement of ground water in the basin follows the topography of the basin.
7. Alturas Basin ground waters are generally of good mineral quality and suitable for most domestic and agricultural uses.
8. Alturas Basin ground waters are generally sodium bicarbonate in character.
9. Data from 141 wells indicate that eight wells produce water with dissolved solids concentrations which exceed levels recommended for domestic use.
10. Data from 141 wells indicate that 11 wells produce water which could cause severe problems if used for irrigation.
11. The mineral quality of the ground water coming from springs and artesian wells in the fringe areas and near recharge areas is usually excellent.
12. The median electrical conductivity of the ground water sampled in Alturas Basin is 335 μ mhos/cm.
13. The median chloride concentration of the ground water sampled in Alturas Basin was 8 mg/L with only one well water exceeding 250 mg/L.
14. The median sulfate concentration in the ground waters of Alturas Basin was 16 mg/L, but four well waters contained concentrations exceeding 250 mg/L.
15. The median boron concentration in Alturas Basin ground water was 0.03 mg/L with four well waters exceeding 2 mg/L.

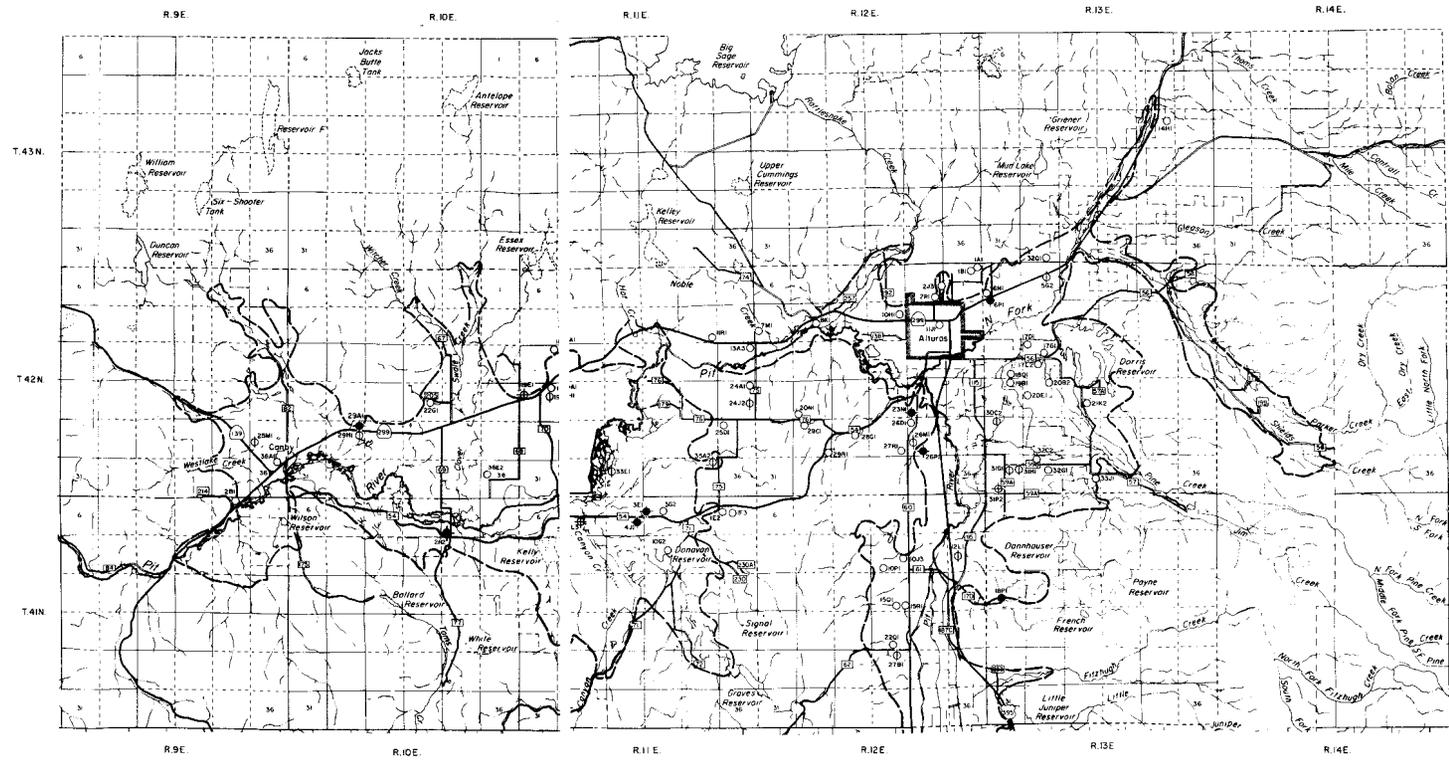
CONCLUSIONS

This investigation has resulted in the following conclusions:

1. Any further water resource development in the Alturas basin will probably be dependent on ground water.
2. Although ground water quality changes have occurred in a few well waters, there are no significant trends of change in the ground waters of the basin.
3. Well waters obtained from some of the confined areas of the upper Alturas Formation can be expected to be poor in quality and are not recommended for domestic or irrigation use.
4. New wells that draw water from the upper Alturas Formation should have the water quality checked before it is utilized.
5. Monitoring of both ground water levels and quality should be continued in this basin.
6. Recharge areas should be protected from extensive development which could interfere with recharge or result in ground water pollution.

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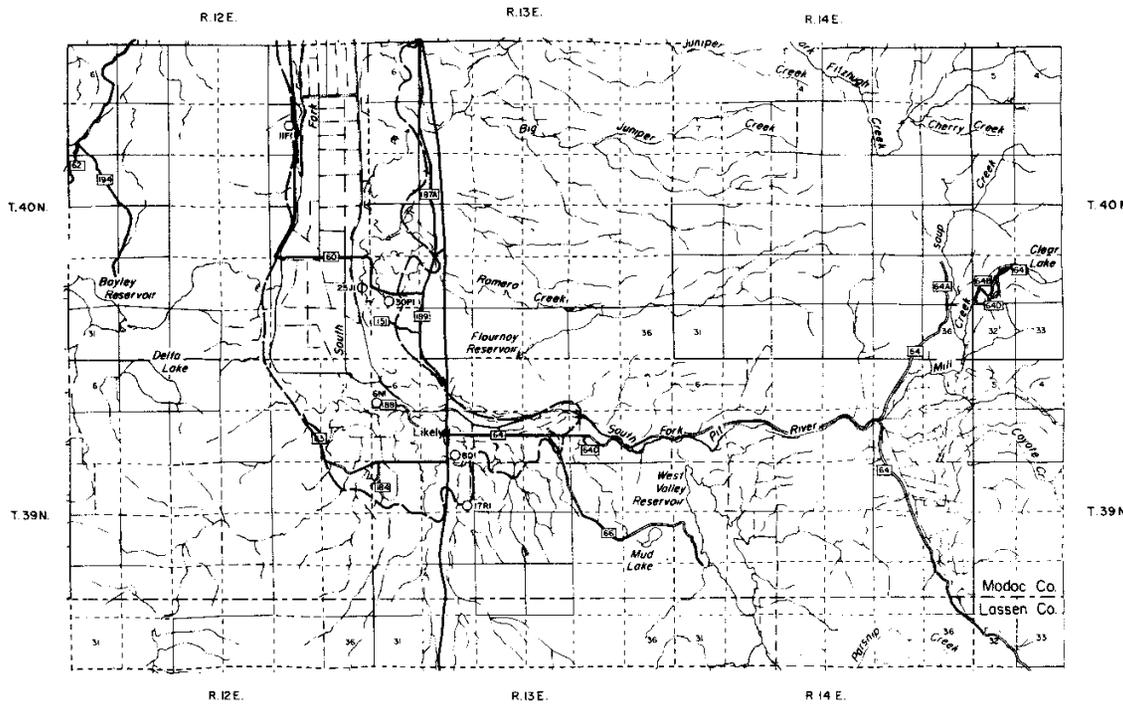
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- Legend
- Well and Number
 - Domestic Good Quality and Class I Irrigation
 - Domestic Very Poor Quality
 - Class II Irrigation Good to Injurious
 - Class III Irrigation Injurious to Unsatisfactory
 - Ground Water Basin Boundary



WELL LOCATION
Alturas Ground Water Basin
Water Quality Study
1986



- Legend
- (2LI) Measured Well and Number
 - Domestic Good Quality and Class I Irrigation
 - Domestic Very Poor Quality
 - ⊕ Class II Irrigation Good to Injurious
 - ⊖ Class III Irrigation Injurious to Unsatisfactory
 - Ground Water Basin Boundary



STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES
NORTHERN DISTRICT

**Well Location
Alturas Ground Water Basin
Water Quality Study
1986**

APPENDIX A
WATER QUALITY CRITERIA

WATER QUALITY

Guidelines for Interpretation of
Water Quality for Agriculture
(UC-Committee of Consultants)

Guidelines were originally distributed to Cooperative Extension staff in December 1973. Suggestions for needed changes, additions, and corrections have been made as received. The present "guidelines" are revised to January 15, 1975 and include -

1. Guidelines for Interpretation of Quality of Water for Irrigation.
2. Assumptions and Comments on "Guidelines".
3. Crop Tolerance and Leaching Requirement Tables - Field Crops.
4. " " " " " " --Vegetable Crops.
5. " " " " " " - Fruit Crops
6. " " " " " " - Forage Crops
7. Example - Use of Crop Tolerance Tables.
8. Boron in Irrigation Waters.
9. Tolerance of Ornamental Shrubs and Ground Covers to Salinity in Irrigation Water.
10. Recommended Maximum Concentrations of Trace Elements in Irrigation Waters.
11. Guide to Use of Saline Waters for Livestock and Poultry.
12. Guidelines To Levels of Toxic Substances in Drinking Water For Livestock.
13. Tables for Calculating pHc Values of Waters.

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Guidelines for Interpretation of Quality of Water for Irrigation

Interpretations are based on possible effects of constituents on crops and/or soils. Guidelines are flexible and should be modified when warranted by local experience or special conditions of crop, soil, and method of irrigation.

TABLE A-1

<u>PROBLEM AND RELATED CONSTITUENT</u>	<u>WATER QUALITY GUIDELINES</u>		
	<u>No Problem</u>	<u>Increasing Problems</u>	<u>Severe Problems</u>
<u>Salinity</u> ^{1/}			
EC _w of irrigation water, in millimhos/cm	<0.75	0.75-3.0	>3.0
<u>Permeability</u>			
EC of irrigation water, in mmho/cm	>0.5	<0.5	<0.2
adj. SAR ^{2/}	<6.0	6.0-9.0	>9.0
<u>Specific Ion Toxicity</u> ^{3/}			
<u>from ROOT absorption</u>			
Sodium (evaluate by adj. SAR)	<3	3.0-9.0	>9.0
Chloride (me/L)	<4	4.0-10	>10
(mg/L or ppm)	<142	142-355	>355
Boron (mg/L or ppm)	<0.5	0.5-2.0	2.0-10.0
<u>from FOLIAR absorption</u> ^{4/} (sprinklers)			
Sodium (me/L)	<3.0	>3.0	--
(mg/L or ppm)	<69	>69	--
Chloride (me/L)	<3.0	>3.0	--
(mg/L or ppm)	<106	>106	--
<u>Miscellaneous</u> ^{5/}			
NH ₄ ⁻ N } mg/L NO ₃ ⁻ N } or for sensitive crops	<5	5-30	>30
ppm			
HCO ₃ (me/L) (only with overhead sprinklers)	<1.5	1.5-8.5	>8.5
(mg/L)	<90	90-520	>520
or			
ppm)			
pH	normal range = 6.5-8.4 --		

- 1/ Assumes water for crop plus needed water for leaching requirement (LR) will be applied. Crops vary in tolerance to salinity. Refer to tables for crop tolerance and LR. (mmho/cmX640 = approximate total dissolved solids (TDS) in mg/L or ppm; mmhoX1000 = micromhos)
- 2/ adj.SAR (Adjusted Sodium Adsorption Ratio) is calculated from a modified equation developed by U. S. Salinity Laboratory to include added effects of precipitation or dissolution of calcium in soils and related to CO₃ + HCO₃ concentrations.

To evaluate sodium (permeability) hazard:

$$\frac{\text{Na}}{\sqrt{\frac{\text{Ca} + \text{Mg}}{2}}} [1 + (8.4 \text{ pHc})]$$

pHc is a calculated value based on total cations. Ca + Mg, and CO₃+HCO₃. Calculating and reporting will be done by reporting laboratory.

NOTE: Na, CA+Mg, CO₃+HCO₃ should be in me/L.

Permeability problems, related to low LC or high adj.SAR of water, can be reduced if necessary by adding gypsum. Usual application rate per acre-foot of applied water is from 200 to about 1,000 lbs. (234 lbs of 100% gypsum added to 1 acre-foot of water will supply 1 me/L of calcium and raise the EC_w about 0.1 mmho.) In many cases a soil application may be needed.

- 3/ Most tree crops and woody ornamentals are sensitive to sodium and chloride (use values shown). Most annual crops are not sensitive (use salinity tolerance tables). For boron sensitivity, refer to boron tolerance tables.
- 4/ Leaf areas wet by sprinklers (rotating heads) may show a leaf burn due to sodium or chloride absorption under low humidity, high-evaporation conditions. (Evaporation increases ion concentration in water films on leaves between rotations of sprinkler heads.)
- 5/ Excess N may affect production or quality of certain crops, e.g. sugar beets, citrus, avocados, apricots, grapes, etc. (1 mg/L NO₃-N = 2.72 lbs, N/acre-foot of applied water.) HCO₃ with overhead sprinkler irrigation may cause a white carbonate deposit to form on fruit and leaves.

<u>Symbol</u>	<u>Name</u>	<u>Symbol</u>	<u>Name</u>	<u>Equiv. Wt.</u>
EC _w	Electrical Conductivity of water	Na	Sodium	23.00
mmho/cm	millimho per centimeter	Ca	Calcium	20.04
<	less than	Mg	Magnesium	12.16
>	more than	CO ₃	Carbonate	30.00
mg/L	milligrams per liter	HCO ₃	Bicarbonate	61.00
ppm	parts per million	NO ₃ ⁻ N	Nitrate-nitrogen	14.00
LR	Leaching Requirement	Cl ⁻	Chloride	35.45
me/L	milliequivalents per liter			
TDS	Total Dissolved Solids			17.1 ppm = 1 grain per gallon

Assumptions and Comments on Guidelines for Interpretation of Quality of Water for Irrigation Developed by University of California Committee of Consultants

1. These "guidelines" are flexible and intended for use in estimating the potential hazards to crop production associated with long-term use of the particular water being evaluated. Guidelines should be modified when warranted by local experience and special conditions of crop, soil, method of irrigation, or level of soil-water-crop management. Changes of 10 to 20 percent above or below an indicated guideline value may have little significance if considered in proper perspective along with all other variables that enter into a yield of crop.
2. It is assumed that the water will be used under average conditions-- soil texture, internal drainage, total water use, climate, and salt tolerance of crop. Large deviations from the average might make it unsafe to use water which under average conditions would be good, or might make it safe to use water, which under average conditions would be of doubtful quality.
3. The divisions into "No problem--Increasing Problem--Severe Problem" is more-or-less arbitrary, as well as carefully controlled greenhouse and small plot research conducted by various researchers over the past 40 years or more. Guidelines of one sort or another have been proposed by U. S. Geological Survey, University of California, U. S. Salinity Laboratory, and many others starting as early as 1911. As new research and observations have developed additional information for assessing water quality, guidelines have been modified.
4. These guidelines apply to surface irrigation methods such as furrow, flood, basin, sprinklers, or any other which applies water on an "as-needed" basis and which allows for an extended dry-down period between

irrigations during which the crop uses up a considerable portion of the available stored water.

5. The guidelines incorporate some of the newer concepts in soil-plant-water relationships as recently developed at U. S. Salinity Laboratory. Uptake of water occurs mostly from the upper two-thirds of the rooting depth of crops (the "more-active" part of the root zone). Each irrigation normally will leach this upper soil area and maintain it at relatively low salinity. Salts applied in the irrigation water under reasonable irrigation management concentrate in the soil water in this active root zone to about three times the concentration of the applied irrigation water and the salinity of this root area is representative of the salinity levels to which the plant responds. The salinity of the lower root zone is of less importance as long as plants are reasonably well supplied with moisture in the upper, more active, root zone.

These guidelines represent the 1974 consensus of the UC Committee of Consultants. It is recognized they are not perfect and it is expected they will be modified from time to time as further knowledge and experience dictate.

CROP TOLERANCE TABLES^{1/}

TABLE A-2. FIELD CROPS

Expected Yield Reduction^{2/}
at EC_e or EC_w indicated

Crop	0%			10%			25%			50%			Maximum ECdw ^{6/}
	ECe ^{3/}	ECw ^{4/}	LR ^{5/}	ECe	ECw	LR	ECe	ECw	LR	ECe	ECw	LR	
Barley ^{7/} (Hordeum vulgare)	8.0 ^{7/}	5.3	10%	10	6.7	12%	13	8.7	15%	18	12	21%	56
Cotton (Gossypium hirsutum)	7.7	5.1	10%	9.6	6.4	12%	13	8.3	15%	17	12	21%	54
Sugarbeet (Beta vulgaris)	7.0 ^{7/}	4.7	10%	8.7	5.8	12%	11	7.5	16%	15	10	21%	48
Wheat ^{7/ 8/} (Triticum aestivum)	6.0 ^{7/}	4.0	10%	7.4	4.9	12%	9.5	6.4	16%	13	8.7	22%	40
Safflower (Carthamus tinctorius)	5.3	3.5	12%	6.2	4.1	14%	7.6	5.0	17%	9.9	6.6	23%	29
Soybean (Glycine max)	5.0	3.3	17%	5.5	3.7	18%	6.2	4.2	21%	7.5	5.0	25%	20
Sorghum (Sorghum bicolor)	4.0	2.7	7%	5.1	3.4	9%	7.2	4.8	13%	11	7.2	20%	36
Groundnut (Arachis hypogaea)	3.2	2.1	16%	3.5	2.4	18%	4.1	2.7	21%	4.9	3.3	25%	13
Rice (paddy) (Oryza sativa)	3.0	2.0	9%	3.8	2.6	11%	5.1	3.4	15%	7.2	4.8	21%	23
Sesbania (Sesbania macrocarpa)	2.3	1.5	6%	3.7	2.5	8%	5.9	3.9	12%	9.4	6.3	19%	33
Corn (grain) (Zea mays)	1.7	1.1	6%	2.5	1.7	8%	3.8	2.5	13%	5.9	3.9	20%	20
Flax (Linum usitatissimum)	1.7	1.1	6%	2.5	1.7	8%	3.8	2.5	13%	5.9	3.9	20%	20

TABLE A-2. FIELD CROPS (Continued)

Crop	Expected Yield Reduction ^{2/} at EC _e or EC _w indicated												Maximum ECd _w ^{6/}
	0%			10%			25%			50%			
	ECe ^{3/}	ECw ^{4/}	LR ^{5/}	ECe	ECw	LR	ECe	ECw	LR	ECe	ECw	LR	
Broadbean (<i>Vicia faba</i>)	1.6	1.1	4%	2.6	1.8	7%	4.2	2.0	12%	6.8	4.5	19%	24
Cowpea (<i>Vigna sinensis</i>)	1.3	0.9	5%	2.0	1.3	8%	3.1	2.1	12%	4.9	3.2	19%	17
Beans (field) (<i>Phaseolus vulgaris</i>)	1.0	0.7	5%	1.5	1.0	8%	2.3	1.5	12%	3.6	2.4	19%	13

TABLE A-3. VEGETABLE CROPS

Crop	Expected Yield Reduction ^{2/} at EC _e or EC _w indicated												Maximum EC _{dw}
	0%			10%			25%			50%			
	ECe	ECw	LR	ECe	ECw	LR	ECe	ECw	LR	ECe	ECw	LR	
Beets ^{7/} (Beta vulgaris)	4.0	2.7	9%	5.1	3.4	11%	6.8	4.5	15%	9.6	6.4	21%	30
Broccoli (Brassica italica)	2.8	1.9	7%	3.9	2.6	10%	5.5	3.7	14%	8.2	5.5	20%	27
Tomato (Lycopersicon esculentum)	2.5	1.7	7%	3.5	2.3	9%	5.0	3.4	13%	7.6	5.0	20%	25
Cucumber (Cucumis sativus)	2.5	1.7	8%	3.3	2.2	11%	4.4	2.9	15%	6.3	4.2	21%	20
Cantaloupe (Cucumis melo)	2.2	1.5	5%	3.6	2.4	7%	5.7	3.8	12%	9.1	6.1	19%	32
Spinach (Spinacia oleracea)	2.0	1.3	4%	3.3	2.2	7%	5.3	3.5	12%	8.6	5.7	19%	30
Cabbage (Brassica oleraceacapitata)	1.8	1.2	5%	2.8	1.9	8%	4.4	2.9	12%	7.0	4.6	19%	24
Potato (Solanum tuberosum)	1.7	1.1	6%	2.5	1.7	8%	3.8	2.5	13%	5.9	3.9	20%	20
Sweet corn (Zea mays)	1.7	1.1	6%	2.5	1.7	8%	3.8	2.5	13%	5.9	3.9	20%	20
Sweet potato (Iponea batatas)	1.5	1.0	5%	2.4	1.6	8%	3.8	2.5	12%	6.0	4.0	19%	21
Pepper (Capsicum frutescens)	1.5	1.0	6%	2.2	1.5	9%	3.3	2.2	13%	5.1	3.4	20%	17

TABLE A-3. VEGETABLE CROPS
(Continued)

Crop	Expected Yield Reduction ^{2/} at EC _c or EC _w indicated												Maximum ECdw
	0%			10%			25%			50%			
	ECe	ECw	LR	ECe	ECw	LR	ECe	ECw	LR	ECe	ECw	LR	
Lettuce (Lactuca sativa)	1.3	0.9	5%	2.1	1.4	8%	3.2	2.1	12%	5.2	3.4	19%	18
Radish (Raphanus sativas)	1.2	0.8	4%	2.0	1.3	7%	3.1	2.1	12%	5.0	3.4	19%	18
Onion (Allium copa)	1.2	0.8	5%	1.8	1.2	8%	2.8	1.8	12%	4.3	2.9	19%	15
Carrot (Daucus carota)	1.0	0.7	4%	1.7	1.1	7%	2.8	1.9	12%	4.6	3.1	19%	16
Beans (Phascolus vulgaris)	1.0	0.7	6%	1.5	1.0	8%	2.3	1.5	12%	3.6	2.4	19%	12.5

TABLE A-4. FRUIT CROPS

Crop	Expected Yield Reduction ^{2/} at EC _e or EC _w indicated												Maximum ECdw
	0%			10%			25%			50%			
	ECe	ECw	LR	ECe	ECw	LR	ECe	ECw	LR	ECe	ECw	LR	
Date palm (Phoenix dactylifera)	4.0	2.7	4%	6.8	4.5	7%	10.9	7.3	11%	17.9	12	19%	64
Fig (Ficus carica)													
Olive (Olea europaea)	2.7	1.8	6%	3.8	2.6	9%	5.5	3.7	13%	8.4	5.6	20%	28
Pomegranate (Punica granatum)													
Grapefruit (Citrus paradisi)	1.8	1.2	8%	2.4	1.6	10%	3.4	2.2	14%	4.9	3.3	21%	16
Orange (Citrus sinensis)	1.7	1.1	7%	2.3	1.6	10%	3.3	2.2	14%	4.8	3.2	20%	16
Lemon (Citrus limonea)	1.7	1.1	7%	2.3	1.6	10%	3.3	2.2	14%	4.8	3.2	20%	16
Apple (Pyrus malus)													
Pear (Pyrus communis)	1.7	1.0	6%	2.3	1.6	10%	3.3	2.2	14%	4.8	3.2	20%	16
Walnut (Juglans regia)	1.7	1.1	7%	2.3	1.6	10%	3.3	2.2	14%	4.8	3.2	20%	16
Peach (Prunus persica)	1.7	1.1	9%	2.2	1.4	11%	2.9	1.9	15%	4.1	2.7	21%	13
Apricot (Prunus armeniaca)	1.6	1.1	9%	2.0	1.3	11%	2.6	1.8	15%	3.7	2.5	20%	12
Grape (Vitis spp.)	1.5	1.0	4%	2.5	1.7	7%	4.1	2.7	11%	6.7	4.5	19%	24
Almond (Prunus amygdalus)	1.5	1.0	7%	2.0	1.4	10%	2.8	1.9	13%	4.1	2.7	20%	14
Plum (Prunus domestica)	1.5	1.0	7%	2.1	1.4	10%	2.9	1.9	14%	4.3	2.8	20%	14

TABLE A-4. FRUIT CROPS
(Continued)

Crop	Expected Yield Reduction ^{2/} at EC _e or EC _w indicated												<u>Maximum</u> ECdw
	0%			10%			25%			50%			
	ECe	ECw	LR	ECe	ECw	LR	ECe	ECw	LR	ECe	ECw	LR	
Blackberry (<i>Rubus</i> spp.)	1.5	1.0	8%	2.0	1.3	11%	2.6	1.8	15%	3.8	2.5	21%	12
Boysenberry (<i>Rubus</i> spp.)	1.5	1.0	8%	2.0	1.3	11%	2.6	1.8	15%	3.8	2.5	21%	12
Avocado (<i>Persea americana</i>)	1.3	0.9	7%	1.8	1.2	10%	2.5	1.7	15%	3.7	2.4	20%	12
Raspberry (<i>Rubus idaeus</i>)	1.0	0.7	6%	1.4	1.0	9%	2.1	1.4	13%	3.2	2.1	19%	11
Strawberry (<i>Fragaria chiloensis</i>)	1.0	0.7	8%	1.3	0.9	10%	1.8	1.2	15%	2.5	1.7	21%	8

TABLE A-5. FORAGE CROPS

Crop	Expected Yield Reduction ^{2/} at EC _e or EC _w indicated												Maximum ECdw
	0%			10%			25%			50%			
	ECe	ECw	LR	ECe	ECw	LR	ECe	ECw	LR	ECe	ECw	LR	
Tall wheat grass (Agropyron elongatum)	7.5	5.0	8%	9.9	6.6	10%	13.3	9.0	14%	19.4	13	21%	63
Wheat grass (fairway) (Agropyron elongatum)	7.5	5.0	11%	9.0	6.0	14%	11	7.4	17%	15	9.8	22%	44
Bermuda grass ^{9/} (Cynodon dactylon)	6.9	4.6	10%	8.5	5.7	13%	10.8	7.2	16%	14.7	9.8	22%	45
Barley (hay) ^{7/} (Hordeum vulgare)	6.0	4.0	10%	7.4	4.9	11%	9.5	6.3	16%	13.0	8.7	22%	40
Perennial rye grass (Lolium perenne)	5.6	3.7	10%	6.9	4.6	12%	8.9	5.9	16%	12.2	8.1	21%	38
Trefoil, birdsfoot ^{10/} narrow leaf (L. corniculatus tenuifolius)	5.0	3.3	11%	6.0	4.0	13%	7.5	5.0	17%	10	6.7	22%	30
Harding grass (Phalaris tuberosa)	4.6	3.1	9%	5.9	3.9	11%	7.9	5.3	15%	11.1	7.4	21%	36
Tall fescue (Festula elatior)	3.9	2.6	6%	5.8	3.9	8%	8.6	5.7	12%	13.3	8.9	19%	46
Crested Wh. grass (Agropyron desertorum)	3.5	2.3	4%	6.0	4.0	7%	9.8	6.5	11%	16	11	19%	57
Vetch (Vicia sativa)	3.0	2.0	8%	3.9	2.6	11%	5.3	3.5	15%	7.6	5.0	21%	24
Sudan grass (Sorghum sudanense)	2.8	1.9	4%	5.1	3.4	7%	8.6	5.7	11%	14.4	9.6	18%	52

TABLE A-5. FORAGE CROPS
(Continued)

Crop	Expected Yield Reduction ^{2/} at EC _e or EC _w indicated												Maximum ECdw
	0%			10%			25%			50%			
	ECe	ECw	LR	ECe	ECw	LR	ECe	ECw	LR	ECe	ECw	LR	
Wildrye, beardless (<i>Elymus triticoides</i>)	2.7	1.8	5%	4.4	2.9	7%	6.9	4.6	12%	11.0	7.4	19%	39
Trefoil, big (<i>Lotus uliginosis</i>)	2.3	1.5	10%	2.8	1.9	13%	3.6	2.4	16%	4.9	3.3	22%	15
Alfalfa (<i>Modicago sativa</i>)	2.0	1.3	4%	3.4	2.2	7%	5.4	3.6	12%	8.8	5.9	19%	31
Lovegrass ^{9/} (<i>Eragrostis</i> spp.)	2.0	1.3	5%	3.2	2.1	8%	5.0	3.3	12%	8.0	5.3	19%	28
Corn (forage) (<i>Zea mays</i>)	1.8	1.2	4%	3.2	2.1	7%	5.2	3.5	11%	8.6	5.7	18%	31
Clover, berseem (<i>Trifolium alexandrinum</i>)	1.5	1.0	3%	3.2	2.2	6%	5.9	3.9	10%	10.3	6.8	18%	38
Orchard grass (<i>Dactylis glomerata</i>)	1.5	1.0	3%	3.1	2.1	6%	5.5	3.7	11%	9.6	6.4	18%	35
Meadow foxtail (<i>Alopecurus pratensis</i>)	1.5	1.0	4%	2.5	1.7	7%	4.1	2.7	11%	6.7	4.5	19%	24
Clover, alsike, ladino, red, strawberry (<i>Trifolium</i> spp.)	1.5	1.0	5.5	2.3	1.6	8%	3.6	2.4	12%	5.7	3.8	19%	20

CROP TOLERANCE TABLES^{1/}

- 1/ Based on data as reported by MAAS and Hoffman (in press); Bernstein, and University of California Committee of Consultants.
- 2/ Expected yield reduction for the particular crop due to indicated salinity of soil or salinity of irrigation water.
- 3/ ECe means electrical conductivity of the saturation extract of the soil reported in millimhos per centimeter at 25° C. Values reported are from MAAS and Hoffman and Bernstein.
- 4/ ECw means electrical conductivity of the irrigation water in millimhos per centimeter at 25° C. This assumes a 15 to 20 percent leaching fraction and an average salinity of soil water equal to about three times that of the irrigation water applied ($EC_{sw} = 3 EC_w$) or about twice that of the soil saturation extract ($EC_{sw} = 2 EC_e$). From the above, $EC_e = 1.5 EC_w$.
- 5/ LR means leaching requirement and is the calculated minimum leaching fraction that can be relied upon to control salts and allow the indicated yield considering tolerance of the particular crop grown and the quality of water used. LR is determined from the equation $LR = EC_w/EC_{dw}$ 6/.
- 6/ Maximum EC_{dw} is the maximum salinity of the percolating water draining from the root zone that can result due to removal of water by the particular crop to meet its water requirement for growth (if all the root zone soil water were at this maximum EC_{dw}, yield reduction would be 100 percent since the crop would be unable to extract water from the very salty soil water). This is the value used as EC_{dw} in the LR calculation ($LR = EC_w/EC_{dw}$). For the given crop and quality of water indicated, application of irrigation water to exactly meet the evapotranspiration demand of crop plus the LR to control salt should result in maximum efficiency of water use. At this efficiency, percolating water draining from the root zone would be minimal as to quantity but at a maximum as to salinity and should approach the maximum EC_{dw} as shown on these crop tolerance tables.
- 7/ Barley, wheat, sugar beets, and several other crops are less tolerant of salts during germination and early seedling growth. For germination of beets, salinity of soil in the seed area should not exceed $EC_e = 3$ mmhos/cm; for barley and wheat, EC_e should not exceed $EC_e = 4$ or 5 mmhos/cm.
- 8/ Tolerance data may not apply to semi-dwarf varieties of wheat. These are often more tolerant.
- 9/ An average of Bermuda grass varieties. Suwanee and Coastal are about 20 percent more tolerant; common and Greenfield are about 20 percent less tolerant.
- 10/ Average of Boer, Wilman, Sand, and Weeping Lovegrass. Lehman appears about 50 percent more tolerant.

EXAMPLE - Use of Crop Tolerance Tables

Crop = Alfalfa

Max. $EC_{dw} = 31$

$$LR\% = \frac{EC_w}{EC_{dw}} \times 100$$

$$\left(\begin{array}{l} \text{Applied water (needed} \\ \text{to supply ET+LR)} = \frac{ET}{1-LR} \end{array} \right)$$

Max. EC_w - From Tables

for 0 yield loss	= 1.3 mmho, LR = 4%
10% " "	= 2.2 " , LR = 7%
25% " "	= 3.6 " , LR = 12%
50% " "	= 5.9 " , LR = 19%

**** 0 yield loss expected with $EC_w < 1.3$

$$EC_w = 0.2 \text{ mmho, LR} = \frac{0.2}{31} \times 100 = .6\%$$

$$EC_w = 0.5 \text{ " , LR} = 1.6\%$$

$$EC_w = 0.75 \text{ " , LR} = 2.4\%$$

$$EC_w = 1.00 \text{ " , LR} = 3.2\%$$

$$EC_w = 1.30 \text{ " , LR} = 4.2\%$$

**** From 0-10% yield loss expected with $EC_w = 1.3-2.2$ mmho

$$EC_w = 1.3 \text{ mmho, LR} = 4.2\%$$

$$EC_w = 1.5 \text{ " , LR} = 4.8\%$$

$$EC_w = 1.75 \text{ " , LR} = 5.6\%$$

$$EC_w = 2.0 \text{ " , LR} = 6.5\%$$

$$EC_w = 2.2 \text{ " , LR} = 7.0\%$$

**** From 10-25% yield loss expected with $EC_w = 2.2-3.6$ mmho

$$EC_w = 2.2 \text{ mmho, LR} = 7.1\%$$

$$EC_w = 2.35 \text{ " , LR} = 7.6\%$$

$$EC_w = 2.50 \text{ " , LR} = 8.1\%$$

$$EC_w = 2.75 \text{ " , LR} = 8.9\%$$

$$EC_w = 3.00 \text{ " , LR} = 9.7\%$$

$$EC_w = 3.30 \text{ " , LR} = 10.6\%$$

$$EC_w = 3.6 \text{ " , LR} = 11.6\%$$

**** From 25-50% yield loss expected with $EC_w = 3.6-5.9$ mmho

$EC_w = 3.6$ mmho, LR = 11.6%

$EC_w = 3.80$ " , LR = 12.3%

$EC_w = 4.00$ " , LR = 12.9%

$EC_w = 4.50$ " , LR = 14.5%

$EC_w = 5.0$ " , LR = 16.1%

$EC_w = 5.3$ " , LR = 17.1%

$EC_w = 5.9$ " , LR = 19.0%

Boron in Irrigation Waters

Boron toxicity in many areas is traceable to use of irrigation waters with boron content in excess of 1 ppm. The University of California Agricultural Extension laboratories are using the following interpretation as regards boron content of irrigation water:

Below 0.5 mg/l - Satisfactory for all crops.

0.5- 1.0 mg/l - Satisfactory for most crops; sensitive crops may show injury (may show leaf injury but yields may not be affected).

1.0- 2.0 mg/l - Satisfactory for semi-tolerant crops. Sensitive crops are usually reduced in yield and vigor.

2.0-10.0 mg/l - Only tolerant crops produce satisfactory yields.

There is no economically feasible method of removing boron from irrigation water. Similarly, there is at present no chemical or soil amendment which can economically be added to the soil to render the boron non-toxic. However, growers in some areas are learning to live with marginal boron and salinity conditions by: (1) maintaining fertility levels slightly above the usual "optimum", and (2) by irrigating a little more frequently than "normal".

TABLE A-6

RELATIVE TOLERANCE OF PLANTS TO BORON

(In each group the plants first named are considered as being more sensitive and the last named more tolerant.)

<u>Sensitive</u>	<u>Semi-Tolerant</u>	<u>Tolerant</u>
0.5 mg/l	1 mg/l	2 mg/l
Lemon	Lima Bean	Carrot
Grapefruit	Sweet Potato	Lettuce
Avocado	Bell Pepper	Cabbage
Orange	Tomato	Turnip
Thornless Blackberry	Pumpkin	Onion
Apricot	Zinnia	Broad Bean
Peach	Oat	Gladiolus
Cherry	Milo	Alfalfa
Persimmon	Corn	Garden Beet
Kadota Fig	Wheat	Mangel
Grape (Sultanina & Malaga)	Barley	Sugar Beet
Apple	Olive	Palm (Phoenix Canariensis)
Pear	Ragged Robin Rose	Date Palm (Phoenix Dactylifera)
Plum	Field Pea	Asparagus
American Elm	Radish	Athel (Tamarix Aphylla)
Navy Bean	Sweet Pea	10 mg/l
Jerusalem Artichoke	Pima Cotton	
Persian (English) Walnut	Acala Cotton	
Black Walnut	Potato	
Pecan	Sunflower (Native)	
1.0 mg/l	2 mg/l	

Adopted from USDA Tech. Bull. No. 448

TABLE A-7

TOLERANCE OF ORNAMENTAL SHRUBS AND GROUND COVERS
TO SALINITY IN IRRIGATION WATER 1/

<u>Sensitive</u> ^{2/} ($EC_w = .75-1.50$) ^{3/}	<u>Moderately Tolerant</u> ($EC_w = 1.50-3.0$)	<u>Tolerant</u> (more than $EC_w = 3.0$)
Star jasmine (<i>Trachelospermum</i> <i>jasminoides</i>)	<i>Pittosporum</i> (<i>P. tobira</i>)	Oleander (<i>Nerium oleander</i>)
Pineapple guava (<i>Feijoa sellowiana</i>)	<i>Viburnum</i> (<i>V. tinus</i> v. <i>robustum</i>)	<i>Pyracantha</i> (<i>P. graeberi</i>)
Burford holly (<i>Ilex cornuta</i> Burford)	Texas privet (<i>Ligustrum lucidum</i>)	Rosemary (<i>Rosmarinus lockwoodi</i>)
Rose (<i>Rosa</i> sp. var. Grenoble on Dr. Huey root)	Lantana (<i>L. camara</i>)	<i>Dracaena</i> (<i>D. endivisa</i>)
Algerian ivy (<i>Hedera canariensis</i>)	Boxwood (<i>Buxus microphylla</i> v. <i>japonica</i>)	<i>Euonymus</i> (<i>E. japonica</i> v. <i>grandiflora</i>)
Hibiscus (<i>H. rosa-sinensis</i> cv. <i>Brilliante</i>)	<i>Xylosma</i> (<i>X. senticosa</i>)	Natal plum (<i>Carissa grandiflora</i>)
Heavenly bamboo (<i>Nandina domestica</i>)	<i>Arborvitae</i> (<i>Thuja orientalis</i>)	<i>Bougainvillea</i> (<i>B. spectabilis</i>)
	<i>Dodonea</i> (<i>D. viscosa</i> v. <i>atropurpurea</i>)	
	Silverberry (<i>Elaeagnus pungens</i>)	
	Spreading juniper (<i>Juniperus chinensis</i>)	
	Bottlebrush (<i>Callistemon viminalis</i>)	

1/ Source: L. Bernstein, L. E. Francois, and R. A. Clark. 1972. "Salt Tolerance of Ornamental Shrubs and Ground Covers. J. Amer. Soc. Hort. Sci. 97(4):550-556.

2/ Listed in decreasing order of sensitivity. EC_w values shown are associated with generally satisfactory appearance and up to 25% decrease in top growth.

3/ EC_w means electrical conductivity of irrigation water (in mmho/cm). Assumptions include the following: $EC_e \times 2 = EC_{sw}$; EC_e = electrical conductivity of soil saturation extract, representative of the more active part of the root zone; EC_{sw} = electrical conductivity of soil water; $EC_w \times 3 = EC_{sw}$, $1/2 EC_{sw} = EC_e$, $^{sw}EC_e = 3/2 EC_w$

TABLE A-8

RECOMMENDED MAXIMUM CONCENTRATIONS OF
TRACE ELEMENTS IN IRRIGATION WATERS ^{1/}

<u>Element</u>	<u>For Waters Used Continuously on All Soil mg/l</u>	<u>For Use Up to 20 Years on Fine Textured Soils of pH 6.0 to 8.5 mg/l</u>
Aluminum	5.0	20.0
Arsenic	0.10	2.0
Beryllium	0.10	0.50
Boron	0.75	2.0
Cadmium	0.010	0.050
Chromium	.10	1.0
Cobalt	.050	5.0
Copper	0.20	5.0
Fluoride	1.0	15.0
Iron	5.0	20.0
Lead	5.0	10.0
Lithium	2.5 ^{2/}	2.5 ^{2/}
Manganese	0.20	10.0
Molybdenum	0.010	0.050 ^{3/}
Nickel	0.20	2.0
Selenium	0.020	0.020
Vanadium	0.10	1.0
Zinc	2.0	10.0

^{1/} These levels will normally not adversely affect plants or soils.
No data available for mercury, silver, tin, titanium, tungsten.

^{2/} Recommended maximum concentration for irrigating citrus is 0.075 mg/l.

^{3/} For only acid fine-textured soils or acid soils with relatively high iron oxide contents.

Source: Above data based on Environmental Studies Board, Nat. Acad. of Sci., Nat. Acad. of Eng. "Water Quality Criteria 1972" (U. S. Gov't. Print. Off., Washington, D. C. 20402), p. 339.

TABLE A-9

GUIDE TO THE USE OF SALINE WATERS
FOR LIVESTOCK AND POULTRY ^{1/}

Total Soluble Salt
Content of Waters (mg/l)

Less than 1,000 mg/l (EC less than 1.5) ^{2/}	Relatively low level of salinity. Excellent for all classes of livestock and poultry.
1,000-2,999 (EC = 1.5-5)	Very satisfactory for all classes of livestock and poultry. May cause temporary and mild diarrhea in livestock not accustomed to them or watery droppings in poultry.
3,000-4,999 (EC = 5-8)	Satisfactory for livestock, but may cause temporary diarrhea or be refused at first by animals not accustomed to them. Poor waters for poultry, often causing water feces, increased mortality and decreased growth, especially in turkeys.
5,000-6,999 (EC = 8-11)	Can be used with reasonable safety for dairy and beef cattle, for sheep, swine, and horses. Avoid use for pregnant or lactating animals. Not acceptable for poultry.
7,000-10,000 (EC = 11-16)	Unfit for poultry and probably for swine. Considerable risk in using for pregnant or lactating cows, horses, or sheep, or for the young of these species. In general, use should be avoided although older ruminants, horses, poultry, and swine may subsist on them under certain conditions.
Over 10,000 (EC over 16)	Risks with these highly saline waters are so great that they cannot be recommended for use under any conditions.

^{1/} Environmental Studies Board, Nat. Acad. of Sci, Nat. Acad. of Eng.
"Water Quality Criteria 1972" (U. S. Gov't. Print. Off., Washington,
D. C. 20402), p. 308.

^{2/} EC values shown are reported as mmho/cm and are only approximations based on rough conversion of given mg/l to EC by $\text{mg/l} \div 640 = \text{EC}$.

TABLE A-10

GUIDELINES TO LEVELS OF TOXIC
SUBSTANCES IN DRINKING WATER FOR LIVESTOCK 1/

<u>Constituent</u>	<u>Upper Limit</u>
Aluminum (Al)	5 mg/l
Arsenic (As)	0.2 mg/l
Beryllium (Be)	No data
Boron (B)	5.0 mg/l
Cadmium (Cd)	.05 mg/l
Chromium (Cr)	1.0 mg/l
Cobalt (Co)	1.0 mg/l
Copper (Cu)	0.5 mg/l
Fluoride (F)	2.0 mg/l
Iron (Fe)	No data
Lead (Pb)	0.1 mg/l ^{2/}
Manganese (Mn)	No data
Mercury (Hg)	.01 mg/l
Molybdenum (Mo)	0.5 mg/l
Nitrate + Nitrite (NO ₃ -N+NO ₂ -N)	100 mg/l
Nitrite (NO ₂ -N)	10 mg/l
Selenium (Se)	0.05 mg/l
Vanadium (Va)	0.10 mg/l
Zinc (Zn)	25 mg/l
Total Dissolved (TDS) Solids	10,000 mg/l ^{3/}

1/ Based primarily on Environmental Studies Board, Nat. Acad. of Sci., Nat. Acad. of Eng., "Water Quality Criteria 1972" (U. S. Gov't. Print. Off., Washington, D. C. 20402), p. 309-317.

2/ Lead is accumulative and problems may begin at threshold value = 0.05 mg/l.

3/ See "Guide to Use of Saline Waters for Livestock and Poultry", included as separate "Guide".

APPENDIX B
WELL DATA

TABLE B-1. WELL DATA

Well No.	Owner	Depth (ft.)	Year Drilled	Log	Well Use	Construction Data
39N/13E/6N1	Don Flournoy	300	1920	no	dom	8" casing
39N/13E/8Q1	D. C. Jeppson	125	1979	yes	dom	6" casing to 23'
39N/13E/17R1	Jim Nelson	310	1979	yes	stock	8" casing to 20'
40N/12E/11F1	Nelson Monroe	800	1915	no	stock	8" casing; artesian
40N/12E/25J1	Pit River Ranch	150		no	dom	
40N/13E/30P1	Charles Williams	205	1970	yes	dom	8" casing
41N/9E/2B1	Wm. Von Borestel	208	1956	yes	dom	6" casing
41N/11E/1E2	Don Crighton	220	1982	yes	dom	6" casing to 20'
41N/11E/2J1	Cal Pines	320		no	dom/irr	8" casing; 2 pumps
41N/11E/1F3	Dennis Huggins	210	1978	yes	dom	6" casing to 40'
41N/11E/3E1	Richard Henry	250		no	dom	cased to 20'
41N/11E/34E3	Gary Riesen	470	old	no	stk/irr	12" casing to 8'
41N/11E/3G2	Orvel Northrup	100	1970	yes	dom	8" casing to 38'
41N/11E/4J1	Winston Campbell	185		yes	dom	
41N/11E/5L3	Diamond C Ranch	100	1971	yes	dom	8" casing to 47'
41N/11E/10G2	Cal. Com. Pines Sv. Dist.	168	1970	yes	mun	
41N/12E/10J3	Floyd McKee	160	1979	no	dom/irr	
41N/12E/10M1	Sid Howard	295	1978	yes	dom	8" casing to 40'
41N/12E/10P1	Sam Peterson	260	1976	no	dom/irr	6" casing to 40'
41N/12E/12L1	Jack Massae	255	1978	yes	dom	12" casing to 40'
41N/12E/15Q1	Fred & John Derner	300	1972	yes	irr	cased to 12'
41N/12E/15R1	John Derner	600	1976	no	irr	open hole

TABLE B-1. WELL DATA (Continued)

Well No.	Owner	Depth (ft.)	Year Drilled	Log	Well Use	Construction Data
41N/12E/22Q1	Lyneta Farms	640	1981	yes	irr	16" casing to 75'
41N/12E/27B1	Lyneta Farms	660	1981	yes	irr	14" casing to 240'/12" cas. 240-360'
41N/13E/18P1	C. E. Massae	280	1946	no	dom	8" casing to 160'
42N/9E/25M1	Wm. Green	505	1969	yes	irr	18" casing to 5'
42N/9E/36A1	Bud Williams	79	1966	yes	dom	8" casing to 47'
42N/10E/22G1	O. W. Porter	160	1968	yes	dom	8" casing to 27'
42N/10E/29H1	J. Harry Manuel	77.2	1982	no	dom	5" casing
42N/10E/36E2	Delas Bone	200	1974	yes	dom	6" casing to 38'
42N/11E/11R1	Victor Cramton	395		no	dom/stk	8" casing
42N/11E/13A3	Norman Van Slyke	200	1974	yes	dom	6" casing
42N/11E/18A1	Sid Collins	395	1980	yes	irr	10" casing to 69'
42N/11E/19A1	Lloyd Royce	359	1980	yes	irr	10" casing to 95'
42N/11E/19E1	Francis Brandon	204	1924	no	dom	8" casing to depth
42N/11E/19H1	Lloyd Roce	390	1980	yes	irr	10" casing to 390'
42N/11E/24A1	Lloyd Goings	114	1941	no	dom/stk	8" casing to 20'
42N/11E/24J2	Gene Brownfield	205	1981	yes	dom	cased to 20'
42N/11E/25D1	Doc Swartes	380		yes	dom	8" casing
42N/11E/33E1	Peter Cary	34		no	dom	5" casing
42N/11E/35A2	Joel Metcalf	350	1982	yes	irr	8" casing to 20'
42N/12E/1A1	Jim Mitchell	150	1980	yes	dom	6" casing to 40'
42N/12E/1B1	Edgar Allen	274	1980	yes	dom	6" casing to 20'
42N/12E/2J3	Gilbert Nolan	195	1981	yes	dom	6" casing

TABLE B-1. WELL DATA (Continued)

Well No.	Owner	Depth (ft.)	Year Drilled	Log	Well Use	Construction Data
42N/12E/2R1	Richard Phillips	280	1979	yes	irr	8" casing to 36'
42N/12E/7M1	John Kelley	260		no	dom	6" casing
42N/12E/8K1	Mr. Huwett	180	1973	yes	dom	8" casing to 40'
42N/12E/10H1	Roy Conners	240		yes	dom	cased to 40'
42N/12E/11J1	City of Alturas	444		no	mun	14" casing
42N/12E/20N1	Dennis Boyle	560	1978	yes	irr	16" casing to 20'
42N/12E/23N1	Modoc County	160	1977	yes	dom	6" casing to 40'
42N/12E/26M1	Robert Wickenden	220	1974	yes	dom	6" casing to 32'
42N/12E/26P1	Glen Jobe	400	1976/77	no	irr	12" casing to 17'
42N/12E/26D1	Norman Van Slyke	285	1978	no	irr	
42N/12E/27R1	Ed Pratt	125	1964	yes	dom	8" casing to 36'
42N/12E/28G1	Gary Segary	240	1981	yes	irr	6" casing to 41'
42N/12E/29C1	Helen R. Perry	225	1978	yes	dom	6" casing to 40'
42N/12E/29R1	BLM	131	1979	yes	dom	6-5/6" casing to 24'6"
42N/13E/31G1	Younger	179		no	dom	
42N/13E/32G1	Steven Baker	80		no	dom	
42N/13E/5G2	Leonard Fitch	700	1977	yes	irr	14" casing to 35'
42N/13E/6N1	Kent Larson	240	1979	yes	irr	8" casing to 40'
42N/13E/6G3	Ron Schluster	105		no	dom	8" casing
42N/13E/6N2	L. E. Harris	260	1974	yes	irr	8" casing to 43'
42N/13E/6P1	Bob Schluter	171.5		no	dom	8" casing
42N/13E/17D1	Stevens Ranch	272		no	dom/stk	4" casing

TABLE B-1. WELL DATA (Continued)

Well No.	Owner	Depth (ft.)	Year Drilled	Log	Well Use	Construction Data
42N/13E/17G1	Warron Schwabel	110	1976	no	dom/irr	
42N/13E/17L2	Earl Sullivan	385	1976	no	irr	16" casing to 18'
42N/13E/18Q1	Dean Neer	660	1979	yes	irr	12" casing
42N/13E/19B1	Dean Neer	200	1981	yes	stock	6" casing to 40'
42N/13E/20B2	Jim Bagwell	271	1979	hes	irr	12" casing to 20'
42N/13E/20E1	W. E. Baker	660	1980	yes	irr	12" casing to 40'
42N/13E/21K2	Tom Rice	265		yes	dom/irr	8" casing to 40'
42N/13E/30C2	Modoc Nat'l. Wldlf. Ref.	250	1980	yes	dom	8" casing to 40'
42N/13E/31H1	John Younger	600	1979	no	stk/irr	16" casing to 40'
42N/13E/31P2	Glen Jobe	400	1973	yes	irr	12" casing / 50-395'
42N/13E/32C2	Ronald Milton	300	1979	yes	irr	12" casing to 15'
42N/13E/33J1	John Weber Ranch	665	1979	yes	irr	12" casing to 18'
43N/13E/14H1	Tom Price (B. Lowes)	250	1976	yes	irr	12" casing to 15'
43N/13E/32Q1	Jack Rice	870	1966	yes	irr	20" and 12" casing

APPENDIX C
MINERAL ANALYSIS OF GROUND WATER

MINERAL ANALYSES OF GROUND WATER

Abbreviations

- TIME - Pacific Standard Time on a 24-hour clock
- TEMP - Water temperature at time of sampling in degrees Fahrenheit (F) and Celsius (C)
- PH - Measure of acidity (<7) or alkalinity (>7) of water
- EC - Electrical conductance in micromhos at 25° Celsius
- TDS - Gravimetric determination of total dissolved solids at 180° C
- SUM - Total dissolved solids by summation of analyzed constituents
- TH - Total hardness
- NCH - Noncarbonate hardness - any excess of total hardness over total alkalinity.
- ASAR - Adjusted sodium adsorption ratio

PERCENT REACTANCE VALUE is determined by dividing the sum of the cations or anions in milliequivalents per liter into each constituent in milliequivalents per liter, arriving at a percentage. For a partial analysis, an approximate value is determined by multiplying the electrical conductance by 0.01 and using that as the cation or anion sum.

MINERAL ANALYSES OF GROUND WATER

DATE TIME	SAMPLER LAB	TEMP	FIELD LABORATORY		MINERAL CONSTITUENTS IN				MILLIGRAMS PER LITER MILLIEQUIVALENTS PER LITER PERCENT REACTANCE VALUE				MILLIGRAMS PER LITER				REM		
			PH	EC	CA	MG	NA	K	CACO3	SO4	CL	NO3	TURB	B	F	TDS SUM		TH NCH	SAR ASAR
			SACRAMENTO HB PITT RIVER HU UPPER PITT RIVER HA CANBY HSA																
08/25/59	5050				2.2	.1	103	8.4	199	30	6.8	.2	.04	.2		6	18.3		
1445	5050		8.1	464	.11	.01	4.48	.21	3.98	.62	.19	.00		73.0	343	0	10.5		
					2	0	93	4	83	13	4	0							
			41N/09E-02A01 M																
08/05/58	5050	60.0F			14	8.5	16	12	107	.3	.8	12.0	.00	.1		70	0.8		
	5050	15.5C	8.1	246	.70	.70	.70	.31	2.14	.01	.02	.19		59.0	187	0	1.2		
					29	29	29	13	91	0	1	8							
			41N/09E-02B01 M																
08/24/82	5050	75.0F	7.5	260	14	8.0	18	12	111	--	1.0	--	--	--		68	0.9		
1335	5050	23.9C	7.6	238	.70	.66	.78	.31	2.22		.03		--	--		0	1.3		
					29	27	32	13											
			41N/09E-10C02 M																
08/05/58	5050	55.0F			25	10	15	5.6	123	5.4	4.7	10.0	.00	.2		105	0.6		
1140	5050	12.6C	8.2	290	1.25	.82	.65	.14	2.46	.11	.13	.16		48.0	197	0	1.0		
					44	29	23	5	86	4	5	6							
			41N/09E-13E01 M																
08/07/58	5050	64.0F			16	3.6	10	3.1	80	.0	.0	.5	.01	.0		55	0.6		
0940	5050	17.8C	7.9	157	.80	.30	.44	.08	1.60	.00	.00	.01		31.0	112	0	0.7		
					49	19	27	5	99	0	0	1							
			41N/10E-02N01 M																
08/25/59	5050				6.6	2.8	152	5.0	156	115	62	1.8	.17	.2		28	12.5		
1415	5050		7.8	768	.33	.23	6.61	.13	3.12	2.39	1.75	.03		62.0	501	0	13.8		
					5	3	91	2	43	33	24	0							
			41N/10E-02N02 M																
08/07/58	5050	65.0F			4.5	1.9	138	5.0	153	94	52	1.5	.21	.1		19	13.8		
0810	5050	18.3C	8.2	689	.22	.16	6.00	.13	3.06	1.96	1.47	.02		57.0	446	0	12.9		
					3	2	92	2	47	30	23	0							
08/24/61	5050				11	1.8	206	5.6	175	168	108	2.0	.15	.2		35	15.2		
1525	5050		8.0	1010	.55	.15	8.96	.14	3.50	3.50	3.05	.03		54.0	661	0	18.5		
					6	2	91	1	35	35	30	0							
08/28/62	5050				13	2.1	258	7.1	194	212	139	2.0	.15	.3		41	17.5		
1100	5050		8.4	1270	.65	.17	11.22	.18	3.68	4.41	3.92	.05		45.0	795	0	23.1		
					5	1	92	1	32	36	32	0							

MINERAL ANALYSES OF GROUND WATER

DATE TIME	SAMPLER LAB	TEMP	FIELD LABORATORY		MINERAL CONSTITUENTS IN					MILLIGRAMS PER LITER MILLIEQUIVALENTS PER LITER				MILLIGRAMS PER LITER				REMARKS	
			PH	EC	CA	MG	NA	K	PERCENT REACTANCE VALUE				B	F	TDS	TH	SAR		
									CaCO3	SO4	CL	NO3	TURB	SD2	SUM	MCH	ASAR		
			SACRAMENTO HB PITT RIVER HU UPPER PITT RIVER HA CANBY HSA																
08/07/58	5050	72.0F			21	.4	272	5.1	219	261	101	23.0	1.5	1.0		54	16.1		
0830	5050	22.2C	8.1	1340	1.05	.03	11.83	.13	4.38	5.43	2.85	.37		44.0	860	0	23.9		
					8	0	91	1	34	42	22	3							
			41N/11E-01A01 M																
08/05/58	5050	64.0F			2.7	.1	44	7.2	87	10	7.9	3.6	.06	.4		7	7.2		
0750	5050	17.8C	8.0	234	.13	.01	1.91	.18	1.74	.21	.22	.06		77.0	205	0	2.4		
					6	0	86	8	78	9	10	3							
			41N/11E-01E02 M																
09/19/82	5050	68.0F	8.0	160	.0	.0	34	4.9	70	--	3.0	--	--	--		0	0.0		
1300	5050	20.0C	7.7	159	.00	.00	1.48	.13	1.40		.08		--	--		0	0.0	S	
					0	0	92	8											
08/25/83	5050	67.0F	7.9	160	--	--	--	--	--	--	--	--	--	--					
1200	0000	19.4C																S	
			41N/11E-01F01 M																
08/07/67	5050	80.5F			1.9	.4	58	5.7	82	29	17	.0	.4	--	222	6	10.3	E	
1650	5050	26.9C	8.0	281	.09	.03	2.52	.15	1.64	.60	.48	.00		--	162	0	2.3	T	
					3	1	90	5	60	22	18	0							
07/24/68	0000	64 F	8.2	295	--	--	--	--	--	--	--	--	--	--					
1035	5050	18 C																S	
			41N/11E-01F03 M																
08/19/82	5050	64.0F	7.4	250	14	3.0	29	10	102	--	5.0	--	.0	.1		48	1.8		
1420	5050	17.8C	7.6	243	.70	.25	1.26	.26	2.04		.14		--	--		0	2.2	S	
					28	10	51	11											
08/25/83	5050	62.0F	7.4	295	--	--	--	--	--	--	--	--	--	--					
1210	0000	16.7C																S	
09/20/84	5050	61.0F	7.3	290	--	--	--	--	--	--	--	--	--	--					
0910	0000	16.1C																S	

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MINERAL ANALYSES OF GROUND WATER

DATE TIME	SAMPLER LAB	TEMP	FIELD LABORATORY		MINERAL CONSTITUENTS IN					MILLIGRAMS PER LITER MILLIEQUIVALENTS PER LITER				MILLIGRAMS PER LITER				REM	
			PH	EC	CA	MG	NA	K	PERCENT REACTANCE VALUE				TDS SUM	TH NCM	SAR ASAR				
									CaCO3	SO4	CL	NO3				TURB	SI02		
A A-23 A-23.E A-23.E1 41N/11E-02G01 M		SACRAMENTO HB PITT RIVER HU UPPER PITT RIVER HA CAMBY HSA																	
09/04/58	5050	62.0F			27	3.0	17	9.1	107	5.8	6.8	5.1	.00	.2		80	0.0		
1040	5050	16.7C	8.1	256	1.35	.25	.74	.23	2.14	.12	.19	.08		69.0	207	0	1.2		
					53	10	29	9	65	5	8	3							
41N/11E-02J01 M																			
08/04/58	5050	64.0F			18	1.2	26	14	102	8.9	7.2	3.9	.00	.3		50	1.6		
1010	5050	17.8C	8.0	259	.90	.10	1.13	.36	2.04	.19	.20	.06		70.0	210	0	2.0		
					36	4	45	14	82	8	8	2							
08/25/59	5050				9.8	.8	45	12	106	23	8.5	1.7	.02	.1		28	3.7		
1540	5050		7.7	297	.49	.07	1.96	.31	2.12	.48	.24	.03		79.0	243	0	3.7		
					17	2	69	11	74	17	8	1							
07/29/60	5050	0 F			11	.6	40	13	103	18	7.6	1.9	.07	.2		30	3.2		
0915	5050	18 C	8.1	271	.55	.05	1.74	.33	2.06	.37	.21	.03		73.0	227	0	3.3		
					21	2	65	12	77	14	8	1							
08/24/61	5050				4.0	.0	63	14	106	38	13	.5	.03	.2		10	8.7		
1355	5050		8.2	331	.20	.00	2.74	.36	2.12	.79	.37	.01		71.0	267	0	4.8		
					6	0	83	11	64	24	11	0							
08/28/62	5050				9.6	1.1	51	13	114	22	8.9	2.0	.1	.2		224	29	4.1	E
1035	5050		8.1	305	.48	.09	2.22	.33	2.28	.46	.25	.03		63.0	239	0	4.3		
					15	3	71	11	75	15	8	1							
09/11/63	5050				15	1.6	31	13	98	13	7.4	3.0	.0	--		221	44	2.0	E
1300	5050		7.8	263	.75	.13	1.35	.33	1.96	.27	.21	.05		--	143	0	2.4	T	
					29	5	53	13	79	11	8	2							
08/27/64	5050				--	--	57	--	107	--	12	--	--	--		18			
0745	5050		8.3	349			2.48		2.14		.34								
							67												
08/12/65	5050				--	--	19	--	--	--	--	--	--	--		61			
	5050			237			.83												
							40												
08/31/66	0000				235	--	--	--	--	--	--	--	--	--					
1250	5050																		

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MINERAL ANALYSES OF GROUND WATER

DATE TIME	SAMPLER LAB	TEMP	FIELD		MINERAL CONSTITUENTS IN					MILLIGRAMS PER LITER				MILLIGRAMS PER LITER				REN			
			LABORATORY							PERCENT REACTANCE VALUE				B	F	TDS	TH		SAR		
			PH	EC	CA	MG	NA	K	CACO3	SO4	CL	NO3	TURB	SID2	SUM	NCH	ASAR				
A A-23 A-23.E A-23.E1 41N/11E-02J01 M		SACRAMENTO HB PITT RIVER HU UPPER PITT RIVER HA CANBY HSA					CONTINUED														
08/07/67 1710	5050 5050	62.0F 16.7C		277	--	--	39	--	--	--	8.8	--	--			37					
			8.0				1.70				.25									S	
07/24/68 1045	0000 5050	68 F 20 C	8.0	255	--	--	--	--	--	--	--	--	--								
07/17/69 1410	5050 5050	70.0F 21.1C	7.9 8.1	275 274	14 .70 23	4.4 .36 12	37 1.61 53	--	106 2.12	--	8.6 .24	--	--			53 0	2.2 2.8			S	
07/23/70 0810	5050 5050	72 F 22 C	8.0	260 260	--	--	37 1.61 66	--	102 2.04	--	7.0 .20	--	--			42				S	
07/28/71 0955	5050 5050	70 F 21 C	8.0 8.2	238 240	12 .60 24	1.4 .12 5	31 1.35 54	16 .41 17	103 2.06 88	5.9 .12 5	4.6 .13 6	1.9 .03 1	.0	--	191 135	37 0	2.2 2.5			E T	
03/24/72 1550	5050 5050	64.0F 17.8C	7.4	255	--	--	--	--	--	--	--	--	--								
07/31/73 1310	5050 0000	70.0F 21.1C	7.4	240	--	--	--	--	--	--	--	--	--								
07/16/74 1125	5050 5050	63.0F 17.2C	7.4 8.0	238 241	--	--	--	--	98 1.96	--	8.1 .23	4.2 .07	--	--		64				S	
08/24/76 0925	5050 0000	63.0F 17.2C	7.5	220	--	--	--	--	--	--	--	--	--								
08/02/77 1425	5050 5050	69.0F 20.5C	7.5 8.5	255 254	23 1.15 48	2.0 .16 7	20 .87 36	9.0 .23 10	101 2.02 83	6.0 .12 5	7.0 .20 8	5.1 .08 3	.0	--	204 133	65 0	1.1 1.5			E T	
08/22/78 0835	5050 0000	65.0F 18.3C	7.5	235	--	--	--	--	--	--	--	--	--								S

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MINERAL ANALYSES OF GROUND WATER

DATE TIME	SAMPLER LAB	TEMP	FIELD LABORATORY PH EC	MINERAL CONSTITUENTS IN				MILLIGRAMS PER LITER MILLIEQUIVALENTS PER LITER				MILLIGRAMS PER LITER				REM
				CA	MG	NA	K	PERCENT REACTANCE VALUE				TDS SUM	TH MCH	SAR ASAR		
								CaCO3	SO4	CL	NO3				TURB	

A A-23 A-23.E A-23.E1 41N/11E-02J01 M																
SACRAMENTO HB PITT RIVER HU UPPER PITT RIVER HA CANBY HSA																
07/10/79	5050	68.0F	7.5	240	--	--	--	--	--	--	--	--	--	--	--	
0840	0000	20.0C														S
03/12/80	5050	65.0F	7.6	260	--	--	--	--	--	--	--	--	--	--	--	S
0900	0000	18.3C														
08/11/81	5050	69.0F	7.7	245	--	--	--	--	--	--	--	--	--	--	--	S
0950	0000	20.5C														
08/17/82	5050	66.0F	7.6	250	22	3.0	19	11	96	--	7.0	--	.0	--	68	1.0
0850	5050	18.9C	8.2	239	1.10	.25	.83	.28	1.92		.20			--	0	1.4
41N/11E-03F01 M																
08/24/82	5050	67.0F	7.1	2350	135	44	279	31	180	--	275	--	.0	.2	518	5.3
0930	5050	19.4C	7.8	2260	6.74	3.62	12.14	.79	3.60		7.76			--	338	12.4
04/20/83	5050	56.0F	7.0	2400	130	44	288	32	175	626	271	.0	.1	--	1620	506
1130	5050	13.3C	7.9	2200	6.49	3.62	12.93	.82	3.50	13.03	7.64	.00		--	1496	331
41N/11E-03G02 M																
08/24/82	5050	61.0F	8.2	375	1.0	.0	79	6.0	118	--	21	--	--	--	2	24.3
0735	5050	16.1C	8.0	378	.05	.00	3.44	.15	2.36		.59			--	0	2.8
08/25/83																
1305	5050	59.0F	8.0	390	--	--	--	--	--	--	--	--	--	--	--	
15.0C																

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CONTINUED

MINERAL ANALYSES OF GROUND WATER

DATE TIME	SAMPLER LAB	TEMP	FIELD LABORATORY		MINERAL CONSTITUENTS IN					MILLIGRAMS PER LITER				MILLIGRAMS PER LITER				REMARKS		
			PH	EC	CA	MG	NA	K	CACO3	SO4	CL	NO3	TURB	SI02	TDS SUM	TH NCH	SAR ASAR			

				SACRAMENTO HB																
				PITT RIVER HU																
				UPPER PITT RIVER HA																
				CANBY HSA																
08/24/82	5050	66.0F	7.4	1500	23	10	272	30	133	--	150	--	.0	.4		98	12.0			
1000	5050	18.9C	8.0	1510	1.15	.02	11.83	.77	2.66		4.23		--	--		0	18.1	S		
				8 6 81 5																
04/20/83	5050	56.0F	7.3	1525	22	10	261	28	140	353	148	7.5	.1	--	989	96	11.6			
1145	5050	13.3C	8.1	1470	1.10	.82	11.35	.72	2.80	7.35	4.17	.12	--	914	0	17.8	S			
				8 6 81 5																
				41N/11E-04J01 M																
03/04/88	5050	57.0F			120	36	71	19	93	79	140	310	.00	.2		447	1.5			
1150	5050	13.9C	7.6	1330	5.99	2.96	3.09	.49	1.86	1.64	3.95	5.00	78.0	909	355	3.0				
				48 24 25 4 15 13 32 40																
				41N/11E-05L01 M																
08/24/82	5050	78.0F	7.3	615	3.0	1.0	122	15	155	--	30	--	.0	.2		12	15.3			
1030	5050	25.5C	8.1	606	.15	.08	5.31	.38	3.10		.85		--	--		0	11.5	S		
				3 1 90 6																
04/20/83	5050	56.0F	7.1	615	3.0	1.0	121	14	146	97	29	4.4	.1	--	448	12	15.2	E		
1200	5050	13.3C	8.2	603	.15	.08	5.26	.36	2.92	2.02	.82	.07	--	357	0	11.0	T			
				3 1 90 6 50 35 14 1																
				41N/11E-10G01 M																
08/25/83	5050	65.0F	8.3	455	--	--	--	--	--	--	--	--	--	--						
1250	0000	18.3C																S		
				41N/11E-10G02 M																
08/24/82	5050	64.0F	8.4	440	1.0	.0	96	7.6	155	--	19	--	.1	--		2	29.5			
0755	5050	17.8C	8.0	450	.05	.00	4.18	.19	3.10		.54		--	--		0	0.2	S		
				1 0 95 4																
09/20/84	5050	65.0F	8.3	445	--	--	--	--	--	--	--	--	--	--						
0930	0000	18.3C																		

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MINERAL ANALYSES OF GROUND WATER

DATE TIME	SAMPLER LAB	TEMP	FIELD LABORATORY PH EC	MINERAL CONSTITUENTS IN				MILLIGRAMS PER LITER MILLIEQUIVALENTS PER LITER PERCENT REACTANCE VALUE				MILLIGRAMS PER LITER				SAR ASAR	REN
				CA	MG	NA	K	CAC03	SO4	CL	NO3	TURB	F SIO2	TDS SUM	TH NCH		
A A-23 A-23.E A-23.E1 41N/11E-21P01 M		SACRAMENTO HB PITT RIVER HU UPPER PITT RIVER HA CANBY HSA															
08/04/58	5050	78.0F		5.1	.6	25	3.7	69	1.2	1.5	1.1	.01	.1		15	2.8	
1510	5050	25.5C	8.3 145	.25 17	.05 3	1.09 74	.09 6	1.38 95	.02 1	.04 3	.02 1		41.0	121	0	1.6	
41N/11E-26802 M																	
08/04/58	5050	62.0F		9.2	2.7	22	4.5	77	3.0	3.6	3.1	.22	.1		34	1.6	
1710	5050	16.7C	8.1 172	.46 26	.22 13	.96 55	.12 7	1.54 88	.06 3	.10 6	.05 3		44.0	138	0	1.6	
41N/11E-29H01 M																	
08/04/58	5050	65.0F		3.4	.0	60	1.3	128	3.6	2.4	1.0	.00	.7		8	9.2	
1540	5050	18.3C	8.1 260	.17 6	.00 0	2.61 93	.03 1	2.56 94	.07 3	.07 3	.02 1		53.0	201	0	5.0	
41N/11E-29J01 M																	
08/04/58	5050	57.0F		18	3.2	15	4.1	91	.6	1.2	2.1	.00	.2		58	0.9	
1620	5050	13.9C	7.9 184	.90 47	.26 14	.65 34	.10 5	1.82 96	.01 1	.03 2	.03 2		62.0	161	0	1.1	
42N/09E-23K01 M																	
08/05/58	5050	60.0F		12	8.3	32	9.7	122	5.1	8.4	5.4	.05	.2		64	1.7	
1420	5050	15.5C	8.2 292	.60 21	.68 23	1.39 48	.25 9	2.44 85	.11 4	.24 8	.09 3		72.0	226	0	2.5	
42N/09E-25M01 M																	
08/24/82	5050	69.0F	7.7	360	9.0	7.0	53	18	161	--	6.0	--	.0	.2		52	3.2
1315	5050	20.5C	8.0 357	.45 12	.58 15	2.31 61	.46 12	3.22		.17			--		0	4.6	
42N/09E-26J01 M																	
08/05/58	5050	56.0F		30	19	28	7.8	185	27	6.7	.6	.06	.4		153	1.0	
1340	5050	13.3C	8.2 430	1.50 33	1.56 35	1.22 27	.20 4	3.70 83	.56 13	.19 4	.01 0		59.0	289	0	1.9	

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MINERAL ANALYSES OF GROUND WATER

DATE TIME	SAMPLER LAB	TEMP	FIELD LABORATORY		MINERAL CONSTITUENTS IN				MILLIGRAMS PER LITER MILLIEQUIVALENTS PER LITER PERCENT REACTANCE VALUE				MILLIGRAMS PER LITER				REM		
			PH	EC	CA	MG	NA	K	CACO3	SO4	CL	NO3	TURB	B	F	TDS		TH	SAR
														SI02	SUM	NCH		ASAR	

	A A-23 A-23.E A-23.E1 42N/09E-35R01 M		SACRAMENTO HB PITT RIVER HU UPPER PITT RIVER HA CANBY HSA																
08/05/58	5050	60.0F			5.5	3.8	56	9.8	148	8.9	3.4	3.4	.03	.2		29	4.5		
1240	5050	15.5C	8.2	325	.27	.31	2.44	.25	2.96	.19	.10	.03		65.0	245	0	5.2		
					8	9	75	8	90	6	3	2							
	42N/09E-36A01 M																		
08/24/82	5050	61.0F	7.2	310	17	9.0	28	12	136	--	6.0	--	--	--		80	1.4		
1255	5050	16.1C	8.1	303	.85	.74	1.22	.31	2.72		.17					0	2.1		
					27	24	39	10											
08/25/83	5050	65.0F	7.3	360	--	--	--	--	--	--	--	--	--	--					
	0000	18.3C																	
	42N/09E-36L01 M																		
08/05/58	5050	55.0F			34	9.2	31	7.8	169	18	2.9	7.2	.00	.4		123	1.2		
1300	5050	12.8C	8.3	394	1.70	.76	1.35	.20	3.38	.37	.08	.12		58.0	269	0	2.2		
					42	19	34	5	86	9	2	3							
	42N/10E-13G01 M																		
09/05/58	5050	82.0F			--	--	--	--	--	--	--	--	.26	.3					
0930	5050	27.8C		250										44.0					
	42N/10E-22G01 M																		
08/05/58	5050	59.0F			56	27	29	4.8	227	44	25	9.5	.00	.1		249	0.8		
1010	5050	15.0C	8.6	593	2.79	2.22	1.26	.12	4.54	.92	.71	.15		50.0	381	24	1.8		
					44	35	20	2	72	15	11	2							
08/24/82	5050	66.0F	7.7	340	23	10	26	7.0	177	--	4.0	--	.0	.2		98	1.1		
1210	5050	18.9C	8.0	315	1.15	.82	1.13	.18	3.54		.11			--		0	2.0		
					35	25	34	5											
06/15/83	5050	62.0F	7.6	555	44	21	38	6.9	192	42	18	38.0	.1	--	380	197	1.2		
0840	5050	16.7C	8.4	541	2.20	1.73	1.65	.18	3.84	.87	.51	.61		--	323	5	2.4		
					38	30	29	3	66	15	9	10							
07/19/84	5050	64.0F	7.3	465	--	--	--	--	--	--	--	--	--	--					
1235	0000	17.8C																	

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MINERAL ANALYSES OF GROUND WATER

DATE TIME	SAMPLER LAB	TEMP	FIELD		MINERAL CONSTITUENTS IN					MILLIGRAMS PER LITER				MILLIGRAMS PER LITER				REM
			LABORATORY PH	EC	CA	MG	NA	K	PERCENT REACTANCE VALUE				B TURB	F SID2	TDS SUM	TH NCH	SAR ASAR	
									CaCO3	SO4	CL	NO3						

A A-23 A-23.E A-23.E1 42N/10E-29H01 M		SACRAMENTO HB PITT RIVER HU UPPER PITT RIVER HA CAMBY HSA		CONTINUED														
08/25/83 1515	5050 0000	80.0F 26.6C	8.7	260	--	--	--	--	--	--	--	--	--	--	--	--		
42N/10E-31J01 M																		
07/23/56 1230	5050 5050		8.0	351	.60 16	5.5 12	.60 69	5.6 4	164 86	13 7	7.8 6	3.9 2	.00 64.0	.2	270	52 0	3.6 5.2	
08/05/58 1500	5050 5050	57.0F 13.9C	8.4	352	.44 12	4.1 9	2.70 74	5.8 4	157 87	12 7	5.2 4	3.5 2	.12 61.0	.4	257	39 0	4.3 5.6	
42N/10E-36E02 M																		
08/24/82 1135	5050 5050	60.0F 15.5C	7.3 8.2	720 695	.77 3.84 53	14 1.15 16	44 1.91 26	15 .38 5	223 4.46	-- .73	26 --	--	.1 --	.2	250 27	1.2 2.7		
42N/11E-09K01 M																		
08/04/58 0810	5050 5050	90.0F 32.2C	9.3	231	2.0 .10 4	.0 .00 0	48 2.09 94	1.6 .04 2	88 1.76 79	4.1 .09 4	13 .37 17	1.0 .02 1	.11 46.0	.3	169	5 0	9.3 1.7	
08/25/59 5050	5050 5050	92.0F 33.3C	7.9	224	1.6 .08 4	.0 .00 0	48 2.09 94	1.9 .05 2	85 1.70 77	5.9 .12 5	13 .37 17	.4 .01 0	.1 49.0	.3	171 171	3 0	12.1 0.6	
07/29/60 0747	5050 5050	93.0F 33.9C	8.1	219	1.5 .07 3	.0 .00 0	47 2.04 95	1.5 .04 2	83 1.66 78	5.4 .11 5	12 .34 16	.7 .01 0	.12 42.0	.3	160	3 0	11.8 0.7	
42N/11E-18A01 M																		
09/02/82 1300	5050 5050	75.0F 23.9C	9.2 8.8	270 267	1.0 .05 2	.0 .00 0	57 2.48 96	2.5 .06 2	100 2.00	-- .45	16 --	--	.2 --	--		2 0	17.5 2.9	

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MINERAL ANALYSES OF GROUND WATER

DATE TIME	SAMPLER LAB	TEMP	FIELD LABORATORY PH EC	MINERAL CONSTITUENTS IN				MILLIGRAMS PER LITER MILLIEQUIVALENTS PER LITER PERCENT REACTANCE VALUE				MILLIGRAMS PER LITER				REMARKS		
				CA	MG	NA	K	CACO3	SO4	CL	NO3	TURB	SI02	TDS SUM	TH MCH		SAR ASAR	
				SACRAMENTO HB PITT RIVER HU UPPER PITT RIVER HA CANBY HSA														
08/25/83	5050	61.0F	7.4	180	13	4.0	16	3.9	69	6.0	5.0	5.6	.0	--	127	49	1.0	E
1620	5050	16.1C	7.5	179	.65 37	.33 19	.70 39	.10 6	1.38 80	.12 7	.14 8	.09 5	--	--	95	0	1.1	T
09/19/84	5050	64.0F	7.3	180	--	--	--	--	--	--	--	--	--	--				S
1250	0000	17.8C																
				42N/11E-18R01 M														
07/02/82	5050	67.0F	8.1	340	--	--	--	--	--	--	--	--	--	--				S
1230	0000	19.4C																
				42N/11E-19A01 M														
07/02/82	5050	67.0F	8.1	340	--	--	--	--	--	--	--	--	--	--				S
1230	0000	19.4C																
				42N/11E-19E01 M														
08/04/58	5050	59.0F			2.6	.0	99	9.3	195	30	7.1	1.1	.00	.3		6	17.6	
1350	5050	15.0C	8.4	464	.13 3	.00 0	4.31 92	.24 5	3.90 82	.62 13	.20 4	.02 0		67.0	333	0	10.0	
08/25/59	5050				2.2	.1	109	8.4	199	30	6.8	.2	.0	.2	343	6	19.4	E
	5050		8.1	464	.11 2	.01 0	4.74 93	.21 4	3.98 83	.62 13	.19 4	.00 0		73.0	349	0	11.0	S
07/29/60	5050				2.6	.0	100	7.8	195	28	6.6	.7	.05	.2		6	17.8	
0803	5050		8.2	450	.13 3	.00 0	4.35 93	.20 4	3.90 83	.58 12	.19 4	.01 0		66.0	329	0	10.0	
08/24/61	5050	63.0F			2.7	.1	101	9.0	193	30	8.2	.6	.05	.2		7	16.6	
1440	5050	17.2C	8.3	446	.13 3	.01 0	4.39 92	.23 5	3.86 82	.62 13	.23 5	.01 0		64.0	331	0	10.4	
09/11/63	5050				2.2	.1	99	9.5	191	29	6.9	.8	.2	--	353	6	17.6	E
1350	5050		7.7	471	.11 2	.01 0	4.31 92	.24 5	3.82 83	.60 13	.19 4	.01 0		--	262	0	9.8	T
08/27/64	5050				--	--	100	--	189	--	7.1	--	--	--		6		
0830	5050		8.5	470			4.35 97		3.78		.20							S
08/12/65	5050				--	--	99	--	--	--	--	--	--	--		7		
	5050			440			4.31 97											S

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MINERAL ANALYSES OF GROUND WATER

DATE TIME	SAMPLER LAB	TEMP	FIELD LABORATORY PH EC	MINERAL CONSTITUENTS IN				MILLIGRAMS PER LITER MILLIEQUIVALENTS PER LITER				MILLIGRAMS PER LITER				REM	
				CA	MG	NA	K	PERCENT CACD3	REACTANCE SD4	VALUE CL	NO3	B TURB	F SIO2	TDS SUM	TH NCH		SAR ASAR

	A A-23 A-23.E A-23.E1 42N/11E-19E01 M		SACRAMENTO HB PITT RIVER HU UPPER PITT RIVER HA CANBY HSA														
08/12/80 0850	5050 0000	63.0F 17.2C	7.8 485	--	--	--	--	--									
CONTINUED																	
08/11/81 0815	5050 5050	62.0F 16.7C	8.3 460 8.1 455	2.0 .10	.0 .00	--	--	195 3.90	--	6.0 .17	--	--			5 0	S	
08/17/82 0800	5050 0000	64.0F 17.8C	8.2 460	--	--	--	--	--								S	
78	42N/11E-19H01 M																
09/02/82 1215	5050 5050	68.0F 20.0C	8.4 350 8.0 355	6.0 .30	1.0 .08	71 3.09	5.2 .13	133 2.66	--	11 .31	--	.0 --			19 0	7.1 6.5	S
08/05/80 0840	5050 5050	62.0F 16.7C	8.2 489	.9 .04	.0 .00	99 4.31	7.7 .20	130 2.60	36 .75	43 1.21	.5 .01	.05 59.0	.2	324	2 0	30.5 2.6	
08/19/82 0945	5050 5050	71.0F 21.6C	7.3 305 7.8 292	19 .95	1.0 .08	36 1.97	9.9 .25	113 2.26	--	12 .34	--	--			52 0	2.2 2.8	S
08/04/80 0900	5050 5050	56.0F 13.3C	8.1 307	22 1.10	1.9 .16	34 1.48	13 .33	116 2.32	11 .23	12 .34	8.9 .14	.00 69.0	.2	241	63 0	1.9 2.6	
06/15/83 0810	5050 5050	78.0F 25.5C	8.0 725 8.4 715	5.0 .25	1.0 .08	141 6.13	14 .36	159 3.18	172 3.58	7.0 .20	4.6 .07	.1 --	--	528 440	16 0	15.3 13.4	E

MINERAL ANALYSES OF GROUND WATER

DATE TIME	SAMPLER LAB	TEMP	FIELD LABORATORY PH EC	MINERAL CONSTITUENTS IN				MILLIGRAMS PER LITER				MILLIGRAMS PER LITER				REF	
				CA	MG	NA	K	PERCENT REACTANCE VALUE				TDS SUM	TH NCH	SAR ASAR			
								CACG3	SO4	CL	NO3				TURB		SI02

A A-23 A-23.E A-23.E1 42N/11E-30G01 M SACRAMENTO HB PITT RIVER HU UPPER PITT RIVER HA CAMBY HSA																	
06/15/83	5050	72.0F	8.1 650	6.0	1.0	121	14	142	148	9.0	2.4	.0	--	482	19	12.1	E
0830	5050	22.2C	8.4 630	.30	.08	5.26	.36	2.84	3.08	.25	.04	--	--	387	0	11.0	S
				5	1	88	6	46	50	4	1						
42N/11E-33E01 M																	
08/04/82	5050	62.0F		8.3	1.6	84	10	79	83	39	3.2	.0	.3	342	27	7.0	
	5050	16.7C	7.5 492	.41	.13	3.65	.26	1.58	1.73	1.10	.05		65.0	341	0	5.8	
				9	3	82	6	35	39	25	1						
08/24/82	5050	60.0F	7.4 480	7.0	3.0	81	10	89	--	33	--	--	--		30	6.4	
	5050	15.5C	7.7 471	.35	.25	3.52	.26	1.78		.93		--	--		0	6.0	S
				8	6	80	6										
06/15/83	5050	57.0F	7.2 540	16	7.0	77	13	122	79	33	2.1	.1	--	370	69	4.0	E
	5050	13.9C	8.1 515	.80	.58	3.35	.33	2.44	1.64	.93	.03		--	300	0	5.7	
				16	11	66	7	48	33	18	1						
42N/11E-35A02 M																	
08/19/82	5050	65.0F	8.0 295	6.0	.0	53	14	122	--	9.0	--	--	--		15	6.0	
	5050	18.3C	7.9 297	.30	.00	2.31	.36	2.44		.25		--	--		0	4.7	S
				10	0	78	12										
09/20/84	5050	62.0F	7.8 300	--	--	--	--	--	--	--	--	--	--				
	0000	16.7C															
42N/11E-35J01 M																	
08/04/82	5050	66.0F		18	.2	63	8.2	95	52	30	3.9	.56	.4		46	4.1	
	5050	18.9C	8.1 421	.90	.02	2.74	.21	1.90	1.08	.85	.06		80.0	313	0	4.7	
				23	1	71	5	49	28	22	2						
42N/12E-26P01 M																	
08/25/83	5050	75.0F	7.3 1190	--	--	--	--	--	--	--	--	--	--				
	0000	23.9C															S

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MINERAL ANALYSES OF GROUND WATER

DATE TIME	SAMPLER LAB	TEMP	FIELD LABORATORY PH EC	MINERAL CONSTITUENTS IN				MILLIGRAMS PER LITER MILLIEQUIVALENTS PER LITER				MILLIGRAMS PER LITER				REN		
				CA	MG	NA	K	PERCENT REACTANCE VALUE				B	F	TDS	TH		SAR	
				CA	MG	NA	K	CA	SO4	CL	NO3	TURB	SiO2	SUM	NCH		ASAR	
A A-23 A-23.E A-23.E2 39N/12E-02L01 M		SACRAMENTO HB PITT RIVER HU UPPER PITT RIVER HA ALTURAS HSA																
06/02/58	5050	64.0F		10	5.0	18	6.2	79	5.4	2.5	2.1	.0	.1		45	1.2		
1040	5000	17.8C	7.9 139	.50	.41	.78	.16	1.58	.11	.07	.03		45.0	142	0	1.3	C	
				27	22	42	9	88	6	4	2							
39N/13E-05D02 M																		
06/02/58	5050	59.0F		37	8.8	40	1.4	182	31	13	11.0	.0	.2		130	1.5		
1435	9551	15.0C	8.3 345	1.85	.72	1.74	.04	3.64	.65	.37	.18		52.0	303	0	2.9	C	
				43	17	40	1	75	13	8	4						S	
39N/13E-06N01 M																		
06/02/58	5050	70.0F		6.1	1.2	24	4.8	66	7.7	3.5	2.0	.03	.2		20	2.3		
1300	9551	21.1C	7.8 123	.30	.10	1.04	.12	1.32	.16	.10	.03		58.0	147	0	1.6	C	
				19	6	67	8	82	10	6	2							
08/25/59	5050	70.0F		5.7	1.2	25	5.1	69	4.9	3.8	1.0	.04	.1		19	2.5		
1415	5050	21.1C	7.5 169	.28	.10	1.09	.13	1.38	.10	.11	.02		63.0	151	0	1.7		
				18	6	68	8	86	6	7	1							
07/29/60	5050	69.0F		6.6	1.6	27	4.9	77	4.6	3.8	1.4	.07	.2		23	2.4		
0850	5050	20.5C	7.8 175	.33	.13	1.17	.13	1.54	.10	.11	.02		56.0	152	0	2.0		
				19	7	66	7	87	6	6	1							
08/24/61	5050			8.2	1.8	28	5.2	87	2.0	3.3	1.5	.08	.1		28	2.3		
1220	5050		8.0 194	.41	.15	1.22	.13	1.74	.04	.09	.02		55.0	157	0	2.2		
				21	8	64	7	92	2	5	1							
08/28/62	5050			7.2	2.3	30	4.8	81	3.4	5.3	1.0	.1	.1		136	28	2.5	
0820	5050		8.0 170	.36	.19	1.31	.12	1.62	.07	.15	.02		50.0	153	0	2.2	E	
				18	10	66	6	87	4	8	1							
09/12/63	5050			8.4	1.9	31	5.9	89	4.6	4.1	1.2	.0	--		156	29	2.5	
0920	5050		7.7 203	.42	.16	1.35	.15	1.78	.10	.12	.02		--	110	0	2.4	T	
				20	8	65	7	88	5	6	1							
08/27/64	5050			--	--	27	--	85	--	3.7	--	--	--		27			
1015	5050		8.1 189			1.17		1.70		.10							S	
						68												
08/12/65	5050			--	--	26	--	--	--	--	--	--	--		23			
	5050		165			1.13											S	
						71												

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MINERAL ANALYSES OF GROUND WATER

DATE TIME	SAMPLER LAB	TEMP	FIELD LABORATORY PH EC	MINERAL CONSTITUENTS IN				MILLIGRAMS PER LITER MILLIEQUIVALENTS PER LITER PERCENT REACTANCE VALUE				MILLIGRAMS PER LITER				RE4		
				CA	MG	NA	K	CACO3	SO4	CL	NO3	TURB	SIO2	TDS SUM	TH NCH		SAR ASAR	
																		B

	A A-23 A-23.E A-23.E2 39N/13E-06N01 M		SACRAMENTO HB PITT RIVER HU UPPER PITT RIVER HA ALTURAS HSA															
07/12/79	5050	68.0F	7.2	340	23	9.0	30	7.3	161	12	5.0	4.4	.0	--	249	94	1.7	E
1350	5050	20.0C	8.4	345	1.15	.74	1.65	.19	3.22	.25	.14	.07	--	195	0	2.9	T	
					31	20	44	5	88	7	4	2						
08/13/80	5050	71.0F	7.2	300	--	--	--	--	--	--	--	--	--	--				
1245	0000	21.6C																
08/13/81	5050	70.0F	7.4	240	--	--	--	--	--	--	--	--	--	--				
1400	0000	21.1C																
08/19/82	5050	67.0F	7.3	250	14	5.0	33	6.3	115	--	5.0	--	.0	--		56	1.9	
1410	5050	19.4C	8.3	261	.70	.41	1.44	.16	2.30		.14		--			0	2.6	S
					26	15	53	6										
08/25/83	5050	67.0F	7.3	215	--	--	--	--	--	--	--	--	--	--				
0830	0000	19.4C																
06/02/58	5050	54.0F			67	34	28	4.4	357	5.8	3.5	2.7	.0	.2		308	0.7	
0950	9551	12.2C	8.3	490	3.34	2.80	1.22	.11	7.13	.12	.10	.04		42.0	401	0	1.7	C
					45	37	16	1	96	2	1	1						
11/18/55	5050				20	6.6	29	7.9	134	7.0	6.0	1.5	.00	.1		77	1.4	
1700	5050		7.9	288	1.00	.54	1.26	.20	2.68	.15	.17	.02		47.0	205	0	2.2	
					33	18	42	7	89	5	6	1						
06/02/58	5050	59.0F			20	8.3	27	8.2	133	7.9	4.5	2.4	.0	.1		84	1.3	
1235	9551	15.0C	8.1	220	1.00	.69	1.17	.21	2.66	.16	.13	.04		44.0	202	0	2.0	C
					33	22	38	7	89	5	4	1						

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MINERAL ANALYSES OF GROUND WATER

DATE TIME	SAMPLER LAB	TEMP	FIELD LABORATORY		MINERAL CONSTITUENTS IN				MILLIGRAMS PER LITER MILLIEQUIVALENTS PER LITER				MILLIGRAMS PER LITER				REMARKS	
			PH	EC	CA	MG	NA	K	PERCENT REACTANCE VALUE	SO4	CL	NO3	TURB	B	F	TDS SUM		TH NCH
A A-23 A-23.E A-23.E2 39N/13E-08Q01 M		SACRAMENTO HB PITT RIVER HU UPPER PITT RIVER HA ALTURAS HSA																
08/23/82	5050	68.0F	7.2	445	36	14	35	6.8	180	--	14	--	.0	.1		148	1.3	
1600	5050	20.0C	8.1	437	1.80	1.15	1.52	.17	3.60		.39		--	--		0	2.4	S
					39	25	33	4										
08/25/83	5050	65.0F	7.1	460	--	--	--	--	--	--	--	--	--	--				S
0800	0000	18.3C																
09/19/84	5050	64.0F	7.1	470	--	--	--	--	--	--	--	--	--	--				S
1040	0000	17.8C																
39N/13E-09D01 M																		
06/02/59	5050	56.0F			19	9.5	12	5.4	109	7.7	3.0	2.4	.03	.1		86	0.6	
1350	9551	13.3C	7.8	180	.95	.78	.52	.14	2.18	.16	.08	.04		64.0	188	0	0.9	C
					40	33	22	6	89	7	3	2						
39N/13E-17R01 M																		
08/23/82	5050	74.0F	7.3	162	11	5.0	12	6.0	74	--	3.0	--	--	--		48	0.8	
1620	5050	23.3C	7.4	160	.55	.41	.52	.15	1.48		.08		--	--		0	0.8	S
					34	25	32	9										
08/25/83	5050	60.0F	7.2	162	--	--	--	--	--	--	--	--	--	--				S
0815	0000	15.5C																
39N/13E-18A01 M																		
06/02/58	5050	58.0F			51	23	27	6.4	242	14	7.5	15.0	.0	.2	333	220	0.8	E
	5050	14.4C	8.3	400	2.54	1.89	1.17	.16	4.84	.29	.21	.24		44.0	333	0	1.7	C
					44	33	20	3	87	5	4	4						
40N/12E-11F01 M																		
11/21/55	5050	62.0F			8.8	1.7	21	5.7	67	7.0	4.0	1.5	.09	.1		29	1.7	
1045	5000	16.7C	7.6	162	.44	.14	.91	.15	1.34	.15	.11	.02		71.0	161	0	1.4	
					27	9	55	9	83	9	7	1						
06/03/58	5050	66.0F			9.2	1.2	18	5.8	67	4.8	2.0	1.3	.0	.2		28	1.5	
0845	9551	18.9C	8.0	120	.46	.10	.78	.15	1.34	.10	.06	.02		64.0	146	0	1.2	C
					31	7	52	10	88	7	4	1						
08/25/59	5050	0 F			8.1	1.7	21	5.9	67	4.9	4.0	1.9	.01	.2		27	1.8	
1640	5050	18 C	7.5	171	.40	.14	.91	.15	1.34	.10	.11	.03		78.0	166	0	1.4	
					25	9	57	9	85	6	7	2						

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MINERAL ANALYSES OF GROUND WATER

DATE TIME	SAMPLER LAB	TEMP	FIELD LABORATORY		MINERAL CONSTITUENTS IN				MILLIGRAMS PER LITER MILLIEQUIVALENTS PER LITER PERCENT REACTANCE VALUE				MILLIGRAMS PER LITER				REM	
			PH	EC	CA	MG	NA	K	CACD3	SO4	CL	NO3	TURB	F SiO2	TDS SUM	TH NCH		SAR ASAR
A A-23 A-23.E A-23.E2 40N/12E-11F01 M		SACRAMENTO HB PITT RIVER HU UPPER PITT RIVER HA ALTURAS HSA																
CONTINUED																		
07/29/60	5050	69.0F			8.3	1.8	22	5.9	68	6.1	3.8	1.8	.10	.1	28	1.8		
0930	5050	20.5C	8.0	162	.41	.15	.96	.15	1.36	.13	.11	.03		71.0	162	0	1.5	
					25	9	57	9	83	8	7	2						
08/24/61	5050	71.0F			8.0	2.2	18	5.3	66	4.1	3.3	2.0	.07	.2	29	1.5		
1125	5050	21.6C	8.0	162	.40	.18	.78	.14	1.32	.09	.09	.03		72.0	155	0	1.2	
					27	12	52	9	86	6	6	2						
09/12/63	5050				4.3	4.2	21	5.7	66	4.9	4.2	1.8	.0	--	153	28	1.7	E
0845	5050		7.6	163	.21	.35	.91	.15	1.32	.10	.12	.03		--	86	0	1.4	T
					13	22	56	9	84	6	8	2						
08/27/64	5050				--	--	21	--	70	--	3.2	--	--	--	29			
0940	5050		8.1	173			.91		1.40		.09							S
							61											
08/12/65	5050	72 F			--	--	22	--	--	--	--	--	--	--	29			
	5050	22 C		164			.96											S
							62											
08/29/66	0000			164	--	--	--	--	--	--	--	--	--	--				
	0000																	
08/07/67	5050				--	--	21	--	--	--	3.8	--	--	--	74			
1445	5050		8.2	162			.91				.11							S
							38											
07/24/68	5050	69 F	7.9	165	8.2	2.1	22	--	68	--	3.7	--	--	--	29	1.8		
0900	5050	21 C	8.0	168	.41	.17	.96		1.36		.10				0	1.5		S
					24	10	56											
07/14/69	0000	76.0F	8.3	160	--	--	--	--	--	--	--	--	--	--				
1645	5050	24.4C																
07/22/70	5050	74 F	8.3	161	--	--	--	--	--	--	--	--	.0	.2	32			
1410	5050	23 C		162														
07/27/71	5050	77 F	8.0	162	--	--	--	--	--	--	--	--	--	--				
1430	0000	25 C																

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MINERAL ANALYSES OF GROUND WATER

DATE TIME	SAMPLER LAB	TEMP	FIELD LABORATORY PH EC	MINERAL CONSTITUENTS IN				MILLIGRAMS PER LITER MILLIEQUIVALENTS PER LITER				MILLIGRAMS PER LITER				REM		
				CA	MG	NA	K	PERCENT REACTANCE VALUE				B TURB	F SIO2	TDS SUM	TH NCH		SAR ASAR	
								CACO3	SO4	CL	NO3							

A A-23 A-23.E A-23.E2 40N/12E-11F01 M		SACRAMENTO HB PITT RIVER HU UPPER PITT RIVER HA ALTURAS HSA		CONTINUED														
08/24/72 1245	5050 0000	72.0F 22.2C	7.9 170	--	--	--	--	--	--	--	--	--	--	--	--			
08/02/73 0905	5050 0000	70.0F 21.1C	8.1 160	--	--	--	--	--	--	--	--	--	--	--	--			
07/18/74 0850	5050 0000	70.0F 21.1C	8.0 160	--	--	--	--	--	--	--	--	--	--	--	--			
08/14/75 1355	5050 5050	68.0F	8.0	170	--	--	--	--	66	--	4.4	3.4	--	--	28			
		20.0C	8.0	161	--	--	--	--	1.32	--	.12	.05	--	--		S		
08/26/76 1200	5050 0000	67.0F 19.4C	8.1 160	--	--	--	--	--	--	--	--	--	--	--	--	S		
08/03/77 0815	5050 5050	69.0F	7.9	165	7.9	1.7	21	5.9	64	5.8	4.7	3.0	.0	--	154	27	1.0	E
		20.5C	8.2	165	.39 25	.14 9	.91 57	.15 9	1.28 81	.12 8	.13 8	.05 3	--	--	88	0	1.4	T
08/24/78 1245	5050 0000	63.0F 17.2C	8.0 170	--	--	--	--	--	--	--	--	--	--	--	--	--		
07/12/79 1310	5050 0000	66.0F 18.9C	8.0 165	--	--	--	--	--	--	--	--	--	--	--	--	--		
08/13/80 1325	5050 0000	64.0F 17.8C	8.1 170	--	--	--	--	--	--	--	--	--	--	--	--	--		
08/13/81 1300	5050 0000	67.0F 19.4C	8.7 165	--	--	--	--	--	--	--	--	--	--	--	--	--		
08/19/82 1310	5050 5050	68.0F	8.4	160	8.0	2.0	21	5.8	66	--	3.0	--	--	--	28	1.7		
		20.0C	8.3	161	.40 25	.16 10	.91 56	.15 9	1.32	--	.08	--	--	--	0	1.4	S	

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MINERAL ANALYSES OF GROUND WATER

DATE TIME	SAMPLER LAB	TEMP	FIELD LABORATORY PH EC	MINERAL CONSTITUENTS IN				MILLIGRAMS PER LITER MILLIEQUIVALENTS PER LITER PERCENT REACTANCE VALUE				MILLIGRAMS PER LITER				SAR ASAR	REM
				CA	MG	NA	K	CACO3	SO4	CL	NO3	TURB	F	YDS SUM	TH NCH		
												SID2					

	A A-23 A-23.E A-23.E2 40N/12E-11F01 M		SACRAMENTO HB PITT RIVER HU UPPER PITT RIVER MA ALTURAS HSA														
08/25/83 0910	5050 0000	68.0F 20.0C	7.9 160	-- -- -- --													
CONTINUED																	
	40N/12E-25J01 M																
11/18/55 1600	5050 5000		8.0 443	.19 .95 19	8.9 .73 15	71 3.09 62	9.8 .25 5	232 4.64 93	9.0 .19 4	5.0 .14 3	1.5 .02 0	.16 71.0	.1	334	84 0	3.4 6.0	
06/03/58 0745	5050 9551	58.0F 14.4C	8.3 345	23 1.15 23	8.1 .67 13	66 2.87 58	11 .28 6	233 4.66 95	5.9 .12 2	1.8 .05 1	3.0 .05 1	.0 64.0	.3	323	91 0	3.0 5.5	
08/28/59 1515	5050 5050	64.0F 17.8C	8.1 478	22 1.10 21	10 .82 16	70 3.05 58	10 .26 5	254 5.07 95	7.6 .16 3	2.8 .08 1	1.9 .03 1	.11 77.0	.2	354	96 0	3.1 5.8	
07/29/60 0915	5050 5050	69.0F 20.5C	8.4 457	20 1.00 20	9.0 .74 15	69 3.00 60	10 .26 5	229 4.58 93	9.7 .20 4	4.8 .14 3	1.7 .03 1	.13 71.0	.2	333	87 0	3.2 5.8	
08/24/61 1145	5050 5050	66.0F 18.9C	8.5 464	21 1.05 20	8.9 .73 14	72 3.13 60	11 .28 5	240 4.80 95	7.1 .15 3	3.0 .08 2	2.6 .04 1	.14 70.0	.2	340	89 0	3.3 6.0	
08/28/62 0800	5050 5050		8.4 420	17 .85 18	8.1 .67 14	69 3.00 63	9.5 .24 5	212 4.24 87	12 .25 5	14 .39 8	1.0 .02 0	.2 63.0	.1	312 321	75 0	3.5 5.9	
09/12/63 0900	5050 5050		8.1 429	17 .85 19	6.7 .55 12	64 2.78 63	9.9 .25 6	187 3.74 87	16 .33 8	8.1 .23 5	.9 .01 0	.2 ---	---	305 235	70 0	3.3 5.4	
08/27/64 1005	5050 5050		8.2 460	-- --	-- --	66 2.87 64	-- --	212 4.24	-- --	6.1 .17	-- --	-- --	-- --		81		
08/12/65	5050 5050			-- --	-- --	72 3.13 62	-- --	-- --	-- --	-- --	-- --	-- --	-- --		95		

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MINERAL ANALYSES OF GROUND WATER

DATE TIME	SAMPLER LAB	TEMP	FIELD LABORATORY PH EC	MINERAL CONSTITUENTS IN				MILLIGRAMS PER LITER MILLIEQUIVALENTS PER LITER				MILLIGRAMS PER LITER				REM
				CA	MG	NA	K	PERCENT REACTANCE VALUE				TDS SUM	TH MCH	SAR ASAR		
								CaCO3	SO4	CL	NO3				TURB	

	A A-23 A-23.E A-23.E2 40M/12E-25J01 M		SACRAMENTO HB PITT RIVER HU UPPER PITT RIVER HA ALTURAS HSA													
08/29/66	0000 0000			413	--	--	--	--								
										CONTINUED						
08/07/67	5050 1500		8.4	527	--	--	74	--			5.8	--	--	.2		113
							3.22				.16			--		
							59									
07/24/68	5050 0845	64 F 18 C	7.3 8.2	510 526	24 1.20	10 .82	72 3.13	10 .26	255 5.09	9.4 .20	5.2 .15	2.0 .03	.0 --	348 285	102 0	3.1 5.9
07/14/69	0000 1610	64.0F 17.8C	7.4	510	--	--	--	--								
07/22/70	0000 1345	61 F 16 C	7.3	500	--	--	--	--								
07/27/71	5050 1415	64 F 18 C	7.3 8.3	390 373	12 .60	5.1 .42	63 2.74	9.2 .24	153 3.06	22 .46	11 .31	.8 .01	.0 --	285 215	51 0	3.8 5.4
							69	6	80	12	8	0				
08/24/72	5050 1230	63.0F 17.2C	7.3 8.0	540 532	--	--	74	--	275 5.49	--	7.0	--	--			117
							3.22				.20					
							58									
08/02/73	5050 0925	64.0F 17.8C	7.3	520	--	--	--	--								
07/18/74	5050 0910	66.0F 18.9C	7.3	480	--	--	--	--								
08/14/75	5050 1410	65.0F 18.3C	7.3	520	--	--	--	--								
08/26/76	5050 1220	59.0F 15.0C	7.3	520	--	--	--	--								

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MINERAL ANALYSES OF GROUND WATER

DATE TIME	SAMPLER LAB	TEMP	FIELD LABORATORY		MINERAL CONSTITUENTS IN				MILLIGRAMS PER LITER MILLIEQUIVALENTS PER LITER				MILLIGRAMS PER LITER				REM
			PH	EC	CA	MG	NA	K	PERCENT REACTANCE VALUE	B	F	TDS	TH	SAR			
					CA	MG	NA	K	CaCO3	SO4	CL	NO3	TURB	SiO2	SUM	MCH	ASAR

A A-23 A-23.E A-23.E2 40N/13E-30P01 M SACRAMENTO HB PITT RIVER HU UPPER PITT RIVER HA ALTURAS HSA																	
09/19/84	5050	72.0F	7.9	275	--	--	--	--	--	--	--	--	--	--	--	--	--
1115	0000	22.2C															
CONTINUED																	
06/02/58	5050	110.0F			6.0	.1	40	4.0	65	27	11	--	.14	.4		10	5.5
1900	5000	43.3C	8.3	180	.30	.01	1.74	.10	1.30	.56	.31	--		56.0	184	0	2.0
					14	0	81	5									
06/02/58	5050	110.0F			5.0	.4	46	3.7	71	27	12	--	.2	.3		14	5.4
1515	5000	43.3C	8.3	240	.25	.03	2.00	.09	1.42	.56	.34	--		58.0	196	0	2.9
					11	1	84	4									
06/03/58	5050	57.0F			47	12	29	11	112	30	31	80.0	.0	.1		167	1.0
0940	9551	13.9C	8.1	390	2.35	.99	1.26	.28	2.24	.62	.87	1.29		64.0	371	55	1.7
					48	20	26	6	45	12	17	26					
11/18/55	5000				25	8.2	30	7.2	115	20	17	12.0	.04	.4		96	1.3
1330	5000		7.5	334	1.25	.67	1.31	.18	2.30	.42	.48	.19		70.0	258	0	2.1
					37	20	36	5	68	12	14	6					
08/18/82	5050	67.0F	7.2	380	25	8.0	37	9.7	130	--	17	--	--	--		96	1.6
1450	5050	19.4C	7.9	375	1.25	.66	1.61	.25	2.60		.48				0	2.6	
					33	18	43	7									
08/24/83	5050	67.0F	7.4	225	--	--	--	--	--	--	--	--	--	--			
1440	0000	19.4C															
CONTINUED																	
08/18/82	5050	71.0F	7.3	230	--	--	--	--	--	--	--	--	--	--			
1425	0000	21.6C															
08/24/83	5050	67.0F	7.3	205	15	4.0	19	6.8	91	5.0	3.0	4.2	.0	--	146	54	1.1
1510	5050	19.4C	7.8	204	.75	.33	.83	.17	1.82	.10	.08	.07		--	112	0	1.4
					36	16	40	8	88	5	4	3					

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MINERAL ANALYSES OF GROUND WATER

DATE TIME	SAMPLER LAB	TEMP	FIELD LABORATORY		MINERAL CONSTITUENTS IN				MILLIGRAMS PER LITER HILLIEQUIVALENTS PER LITER PERCENT REACTANCE VALUE				MILLIGRAMS PER LITER				RE4	
			PH	EC	CA	MG	NA	K	CAC03	SO4	CL	NO3	TURB	SI02	TDS SUM	TH NCH		SAR ASAR

	A A-23 A-23.E A-23.E2 41N/12E-10P01 M		SACRAMENTO HB PITT RIVER HU UPPER PITT RIVER HA ALTURAS HSA															
08/18/82	5050	82.0F	7.3	220	16	5.0	23	8.1	111	--	4.0	--	--	--		60	1.3	
1440	5050	27.8C	7.7	227	.80 33	.41 17	1.00 41	.21 9	2.22		.11					0	1.8	
08/24/83	5050	64.0F	7.4	385	34	13	--	--	177	--	9.0	3.3	--	--		139		
1450	5050	17.8C	8.1	381	1.70	1.07			3.54		.25	.05				0		

	41N/12E-12L01 M																	
08/18/82	5050	67.0F	7.6	850	50	9.0	107	16	142	--	104	--	--	--		162	3.7	
1240	5050	19.4C	8.0	857	2.50 30	.74 9	4.65 56	.41 5	2.84		2.93					20	6.6	
04/20/83	5050	60.0F	7.6	875	48	8.0	107	16	116		151	98	2.6	.9	--	589	153	
1050	5050	15.5C	8.1	850	2.40 30	.66 8	4.65 57	.41 5	2.32 28		3.14 38	2.76 33	.04 0		--	501	37	
09/20/84	5050	65.0F	7.4	1100	77	13	121	--	109	--	178	--	--	--		246	3.4	
0800	5050	18.3C	8.0	1110	3.84 38	1.07 11	5.26 52		2.18		5.02					137	6.2	

	41N/12E-15H01 M																	
06/03/58	5050	64.0F			13	1.3	24	7.6	84		7.4	5.8	2.7	.05	.3		38	
0910	9551	17.8C	8.1	160	.65 33	.11 6	1.04 52	.19 10	1.68 83		.15 7	.16 8	.04 2		74.0	186	0	
08/25/58	5050	74.0F			13	1.3	29	7.4	92		7.4	6.6	3.3	.11	.2		38	
1605	5050	23.3C	7.7	228	.65 29	.11 5	1.26 57	.19 9	1.84 83		.15 7	.19 9	.05 2		89.0	212	0	
07/29/60	5050	74.0F			12	1.9	29	7.1	89		6.7	6.3	3.6	.12	.2		38	
1000	5050	23.3C	8.0	220	.60 27	.16 7	1.26 57	.18 8	1.78 82		.14 6	.18 8	.06 3		82.0	202	0	
08/24/61	5050				13	1.3	27	7.0	89		6.6	6.0	3.3	.15	.2		38	
1015	5050		8.0	222	.65 31	.11 5	1.17 55	.18 9	1.78 83		.14 7	.17 8	.05 2		80.0	198	0	
07/12/63	5050				12	1.2	29	8.0	87		7.4	7.4	1.1	.2	--	188	35	
0830	5050		7.7	216	.60 28	.10 5	1.26 58	.20 9	1.74 82		.15 7	.21 10	.02 1		--	118	0	

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MINERAL ANALYSES OF GROUND WATER

DATE TIME	SAMPLER LAB	TEMP	FIELD LABORATORY PH EC	MINERAL CONSTITUENTS IN				MILLIGRAMS PER LITER MILLIEQUIVALENTS PER LITER PERCENT REACTANCE VALUE				MILLIGRAMS PER LITER				REM		
				CA	MG	NA	K	CACO3	SD4	CL	ND3	TURB	B	F	TDS SUM		TH NCH	SAR ASAR

	A A-23 A-23.E A-23.E2 41N/12E-15H01 M		SACRAMENTO HB PITT RIVER HU UPPER PITT RIVER HA ALTURAS HSA															
08/27/64 0910	5050 5050		8.1 219	--	--	27	--	90	--	6.5	--	--	--	--	39			
						1.17		1.80		.18						S		
						60												
08/12/65 5050	5050 5050		218	--	--	29	--	--	--	--	--	--	--	38				
						1.26										S		
						62												
09/21/66 0000	0000 0000		220	--	--	--	--	--	--	--	--	--	--					
08/07/67 1430	5050 5050	71.5F 21.9C	8.2 224	--	--	30	--	--	--	6.7	--	--	--	39				
						1.31				.19						S		
						63												
07/27/71 1530	5050 5050	70 F 21 C	7.3 270 8.1 263	17 .85	2.3 .19	32 1.39	7.8 .20	103 2.06	6.6 .14	8.1 .23	13.0 .21	.0 --	--	228 149	52 0	1.9 2.4	E T	
				32	7	53	8	78	5	9	8							
	41N/12E-15Q01 M																	
09/18/82 1405	5050 5050	77.0F 25.0C	7.7 219 7.7 213	11 .55	2.0 .16	28 1.22	7.9 .20	89 1.78	--	6.0	--	.1	.4	36 0	2.0 2.1			
				26	8	57	9			.17		--	--			S		
	41N/12E-15R01 M																	
08/18/82 1400	5050 5050	81.0F 27.2C	7.8 220 7.8 217	11 .55	1.0 .08	31 1.35	8.0 .20	91 1.82	--	6.0	--	--	--	32 0	2.4 2.4			
				25	4	62	9			.17		--	--			S		
08/24/83 1530	5050 0000	81.0F 27.2C	7.8 218	--	--	--	--	--	--	--	--	--	--					
																S		

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MINERAL ANALYSES OF GROUND WATER

DATE TIME	SAMPLER LAB	TEMP	FIELD LAB	PH	EC	MINERAL CONSTITUENTS IN				MILLIGRAMS PER LITER				MILLIGRAMS PER LITER				SAR	REM
						CA	MG	NA	K	PERCENT	REACTANCE	VALUE	B	F	TDS	TH	ASAR		
						CA	MG	NA	K	CACO3	SO4	CL	NO3	TURB	SI02	SUM	MCH	ASAR	
				SACRAMENTO HB															
				PITT RIVER HU															
				UPPER PITT RIVER HA															
				ALTURAS HSA															
08/20/82	5050	93.0F	8.4	275	--	--	--	--	--	--	--	--	--	--	--				
0825	0000	33.9C																	S
				41N/12E-22001 M															
08/20/82	5050	78.0F	8.4	265	9.0	2.0	43	7.6	102	--	10	--	.2	.3		30	3.4		
0805	9050	25.5C	7.9	266	.45	.16	1.87	.19	2.04		.28			--		0	3.5		S
				41N/12E-27001 M															
08/25/83	5050	67.0F	8.0	315	--	--	--	--	--	--	--	--	--	--					
0930	0000	19.4C																	
				41N/13E-05002 M															
06/03/58	5050	55.0F			40	9.5	14	7.2	129	36	3.9	--	.0	.1		139	0.5		
1045	9551	12.8C	8.2	245	2.00	.78	.61	.18	2.58	.75	.11			52.0	241	10	0.9		S
				41N/13E-18P01 M															
06/05/58	5050	60.0F			111	38	18	12	208	263	16	4.7	.0	.3		412	0.4		
0950	9551	15.5C	8.3	750	5.54	3.13	.78	.31	4.16	5.48	.45	.08		69.0	656	226	0.9		C
				41N/13E-18P01 M															
08/28/59	5050	62.0F			112	45	25	9.5	230	264	14	6.8	.1	.2		680	465	0.5	E
	5050	16.7C	8.1	922	5.59	3.70	1.09	.24	4.60	5.50	.39	.11		66.0	680	235	1.2		
				41N/13E-18P01 M															
08/28/59	5050	62.0F			112	45	25	9.5	230	264	14	6.8	.06	.2		680	465	0.5	
1630	5050	16.7C	8.1	922	5.59	3.70	1.09	.24	4.60	5.50	.39	.11		66.0	680	235	1.2		
				41N/13E-18P01 M															
07/29/60	5050	67.0F			87	28	20	11	199	172	10	3.8	.05	.3		334	0.5		
0800	5050	19.4C	8.4	714	4.34	2.30	.87	.28	3.98	3.58	.28	.06		66.0	517	133	1.1		
				41N/13E-18P01 M															
08/24/61	5050	64.0F			107	40	18	8.8	213	239	12	5.1	.08	.4		430	0.4		
0940	5050	17.8C	8.6	833	5.34	3.29	.78	.23	4.26	4.98	.34	.08		66.0	624	219	0.9		
				41N/13E-18P01 M															
08/28/62	5050	64.0F			90	30	20	9.6	197	173	13	3.0	.1	.1		504	349	0.5	E
0850	5050	17.8C	8.4	660	4.49	2.47	.87	.25	3.94	3.60	.37	.05		61.0	518	151	1.1		C

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MINERAL ANALYSES OF GROUND WATER

DATE TIME	SAMPLER LAB	TEMP	FIELD		MINERAL CONSTITUENTS IN				MILLIGRAMS PER LITER				MILLIGRAMS PER LITER				REM	
			LABORATORY						PERCENT REACTANCE VALUE				B	F	TDS	TH		SAR
			PH	EC	CA	MG	NA	K	CACO3	SO4	CL	ND3	TURB	SIO2	SUM	NCH		ASAR

	A A-23 A-23.E A-23.E2 41N/13E-18P01 M		SACRAMENTO HB PITT RIVER HU UPPER PITT RIVER HA ALTURAS HSA				CONTINUED											
09/10/63	5050				103	50	20	11	216	267	13	4.1	.2	--	722	464	0.4	E
1205	5050		8.0	938	5.14	4.11	.87	.28	4.32	5.56	.37	.07	--	598	247	1.0		
					49	40	8	3	42	54	4	1						
08/25/64	5050				--	--	24	--	230	--	14	--	--	--		529		
1220	5050		8.3	1020			1.04		4.60		.39							
							9											
08/12/65	5050				98	65	--	--	--	311	--	--	--	--		515		
	5050				973	4.89	5.35			6.48								
08/29/66	5050				116	50	--	--	225	306	--	--	--	--		498		
1430	5050		8.1	991	5.79	4.11			4.50	6.37						270		
08/07/67	5050	59.0F			--	--	25	--	--	--	14	--	--	--		530		
1410	5050	15.0C	8.3	1040			1.09				.39							
							9											
07/24/68	5050	59 F	7.1	920	103	46	24	8.7	218	252	13	3.0	.0	--	663	445	0.5	E
1200	5050	15 C	8.3	924	5.14	3.78	1.04	.22	4.36	5.25	.37	.05	--	580	228	1.2		
					50	37	10	2	43	52	4	0						
07/14/69	0000	59.0F	7.0	1010	--	--	--	--	--	--	--	--	--	--				
1420	5050	15.0C																
07/27/71	5050	66 F	7.2	890	--	--	--	--	--	--	--	--	--	--				
1550	0000	19 C																
08/24/72	5050	62.0F	7.3	900	--	--	--	--	--	--	--	--	--	--				
1325	0000	16.7C																
08/02/73	5050	63.0F	7.3	750	--	--	--	--	--	--	13	--	--	--		376		
0820	5050	17.2C									.37							
07/18/74	5050	65.0F	7.3	580	70	24	17	8.5	188	116	9.1	1.6	.0	--	415	275	0.4	
0825	5050	18.3C	8.1	604	3.49	1.97	.74	.22	3.76	2.42	.26	.03	--	359	85	1.0		
					54	31	12	3	58	37	4	0						

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MINERAL ANALYSES OF GROUND WATER

DATE TIME	SAMPLER LAB	TEMP	FIELD LABORATORY		MINERAL CONSTITUENTS IN				MILLIGRAMS PER LITER MILLIEQUIVALENTS PER LITER				MILLIGRAMS PER LITER				REM
			PH	EC	CA	MG	NA	K	PERCENT CACO3	REACTANCE SD4	VALUE CL	NO3	TURB	B SIO2	F TDS SUM	TH NCH	

	A A-23 A-23.E A-23.E2 41N/13E-30L01 M		SACRAMENTO HB PITT RIVER HU UPPER PITT RIVER HA ALTURAS HSA														
06/02/58	5050	56.0F			49	17	16	11	208		24	6.9	--	.03	.2	193	0.5
1540	9551	13.3C	8.3	340	2.45	1.40	.70	.28	4.16	.90	.19	--		52.0	301	0	1.1
					51	29	14	6									S
	42N/10E-29A01 M																
08/25/83	5050	185.0F	8.7	1250	21	.0	--	--	37	--	163	--	3.5	--		52	
1520	5050	84.9C	7.6	1260	1.05	.00			.74		4.60					16	
																	S
	42N/11E-11R01 M																
08/19/82	5050	64.0F	7.3	395	30	10	32	13	169	--	6.0	--	.0	--		116	1.3
0800	5050	17.8C	8.2	386	1.50	.82	1.39	.33	3.38		.17					0	2.3
					37	20	34	8									S
08/25/83	5050	64.0F	7.3	395	--	--	--	--	--	--	--	--	--	--			
1415	0000	17.8C															S
	42N/11E-13A03 M																
09/02/82	5050	60.0F	7.5	530	51	16	32	13	195	--	12	--	.0	.2		193	1.0
1325	5050	15.5C	8.2	520	2.54	1.32	1.39	.33	3.90		.34					0	2.1
					46	24	29	6									S
	42N/11E-24A01 M																
06/04/58	5050	58.0F			21	4.2	13	5.6	84	7.2	7.7	5.9	.0	.3		70	0.7
1035	9551	14.4C	7.5	180	1.05	.35	.57	.14	1.68	.15	.22	.10		56.0	171	0	0.9
					50	17	27	7	78	7	10	5					
07/29/60	5050	57.0F			19	5.2	14	5.8	84	3.0	5.8	9.4	.04	.3		69	0.7
0721	5050	13.9C	7.9	207	.95	.43	.61	.15	1.68	.06	.16	.15		61.0	174	0	1.0
					44	20	29	7	82	3	8	7					
08/24/61	5050	61.0F			18	5.1	13	5.3	79	3.4	5.5	9.5	.05	.3		66	0.7
1335	5050	16.1C	8.0	197	.90	.42	.57	.14	1.58	.07	.16	.15		63.0	170	0	0.9
					44	21	28	7	81	4	8	8					
08/28/62	5050	59.0F			17	5.9	14	5.1	84	2.4	3.5	10.0	.1	.2		146	0.7
1015	5050	15.0C	8.0	200	.85	.49	.61	.13	1.68	.05	.10	.16		49.0	157	0	1.0
					41	24	29	6	84	3	5	8					
09/11/63	5050				17	5.7	12	5.7	76	2.8	5.4	9.1	.2	--		139	0.6
1245	5050		7.6	210	.85	.47	.52	.15	1.52	.06	.15	.15		--	103	0	0.8
					43	24	26	8	81	3	8	8					T

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MINERAL ANALYSES OF GROUND WATER

DATE TIME	SAMPLER LAB	TEMP	FIELD LABORATORY PH EC	MINERAL CONSTITUENTS IN				MILLIGRAMS PER LITER MILLIEQUIVALENTS PER LITER PERCENT REACTANCE VALUE				MILLIGRAMS PER LITER				RE4	
				CA	MG	NA	K	CaCO3	SO4	CL	NO3	TURB	SiO2	TDS SUM	TH NCH		SAR ASAR

	A A-23 A-23.E A-23.E2 42N/11E-24A01 M		SACRAMENTO HB PITT RIVER HU UPPER PITT RIVER HA ALTURAS HSA														
08/12/65	5050 5050			206	--	--	14	--	--						68		
							.61 31									S	
08/28/66	0000 0000			207	--	--	--	--	--								
08/07/67	5050 1605	64.0F 17.8C	7.9	211	--	--	14	--	--	5.4	--	--	--	68			
							.61 31			.15					S		
96 07/22/70	0000 1630	69 F 21 C	7.3	218	--	--	--	--	--	--	--	--	--				
07/28/71	5050 1015	66 F 19 C	7.1	215	--	--	--	--	--	--	--	--	--				
08/24/72	5050 1520	63.0F 17.2C	7.3 7.6	225 211	--	--	--	--	82 1.64	7.4	--	--	--	74			
										.21					S		
07/31/73	5050 1250	62.0F 16.7C	7.3	220	--	--	--	--	--	--	--	--	--		S		
07/16/74	5050 1100	63.0F 17.2C	7.1	210	--	--	--	--	--	--	--	--	--		S		
08/12/75	5050 1030	68.0F 20.0C	7.9	218	--	--	--	--	--	--	--	--	--		S		
08/24/76	5050 0910	62.0F 16.7C	7.2	210	--	--	--	--	--	--	--	--	--		S		
08/02/77	5050 1410	64.0F 17.8C	7.2 8.3	205 226	20 1.00	6.0 .49	15 .65	4.1 .10	87 1.74	4.0 .08	5.0 .14	11.0 .18	.0 --	169 117	74 0	0.8 1.0	E T
					45	22	29	4	81	4	7	8					

MINERAL ANALYSES OF GROUND WATER

DATE TIME	SAMPLER LAB	TEMP	FIELD LABORATORY PH EC	MINERAL CONSTITUENTS IN	MILLIGRAMS PER LITER				MILLIEQUIVALENTS PER LITER				MILLIGRAMS PER LITER				REN	
					CA	MG	NA	K	PERCENT REACTANCE VALUE				B	F	TDS	TH		SAR
					CL	NO3	TURB	SI02	SUM	NCH	ASAR							

	A A-23 A-23.E A-23.E2 42N/11E-24A01 M		SACRAMENTO HB PITT RIVER HU UPPER PITT RIVER HA ALTURAS HSA															
08/22/78	5050	62.0F	7.3	210	--	--	--	--	--									
0820	0000	16.7C																
07/10/79	5050	62.0F	7.2	210	--	--	--	--	--									
0830	0000	16.7C																
08/12/80	5050	64.0F	7.3	225	--	--	--	--	--									
0900	0000	17.8C																
97 08/11/81	5050	63.0F	7.4	220	--	--	--	--	--									
0930	0000	17.2C																
08/17/82	5050	62.0F	7.3	210	18	6.0	14	5.5	83							70	0.7	
0830	5050	16.7C	8.3	208	.90	.49	.61	.14	1.66		5.0					0	1.0	
					42	23	29	7			.14							
08/25/83	5050	62.0F	7.3	220	--	--	--	--	--									
1330	0000	16.7C																
09/20/84	5050	61.0F	7.3	225	--	--	--	--	--									
1025	0000	16.1C																
	42N/11E-24J02 M																	
08/19/82	5050	60.0F	7.2	395	6.0	2.0	79	13	196		4.0					23	7.2	
0915	5050	15.5C	8.0	394	.30	.16	3.44	.39	3.92		.11					0	8.3	
					7	4	81	8										
06/15/83	5050	61.0F	7.3	410	9.0	2.0	--	--	198		4.0		.0			30		
0715	5050	16.1C	8.5	400	.45	.16			3.96		.11					0		

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MINERAL ANALYSES OF GROUND WATER

DATE TIME	SAMPLER LAB	TEMP	FIELD LABORATORY		MINERAL CONSTITUENTS IN					MILLIGRAMS PER LITER MILLIEQUIVALENTS PER LITER PERCENT REACTANCE VALUE				MILLIGRAMS PER LITER				REM	
			PH	EC	CA	MG	NA	K	CACO3	SO4	CL	NO3	TURB	SI02	TDS SUM	TH NCH	SAR ASAR		
A A-23 A-23.E A-23.E2 42N/12E-01A01 M		SACRAMENTO HB PITT RIVER HU UPPER PITT RIVER HA ALTURAS HSA																	
08/17/82	5050	64.0F	7.5	310	30	10	16	6.5	137	--	4.0	--	--	--		116	0.6		
0810	5050	17.8C	7.9	306	1.50	.82	.70	.17	2.74		.11					0	1.1	S	
					47	26	22	5											
08/24/83	5050	63.0F	7.4	335	--	--	--	--	--	--	--	--	--	--					
0805	0000	17.2C																S	
08/16/82	5050	76.0F	7.5	350	--	--	--	--	--	--	--	--	--	--					
1455	0000	24.4C																S	
06/04/82	5050	59.0F			36	11	14	8.2	142	20	8.5	4.2	.0	.2		134	0.5		
1320	9551	15.0C	8.4	270	1.80	.90	.61	.21	2.84	.42	.24	.07		68.0	255	0	0.9	C	
					51	26	17	6	80		12	7	2						
06/04/82	5050	66.0F			36	6.5	14	9.0	139	15	5.4	2.2	.0	.2		117	0.6		
1155	9551	18.9C	8.1	250	1.80	.53	.61	.23	2.78	.31	.15	.04		68.0	239	0	1.0	C	
					57	17	19	7	85		9	5	1						
08/17/82	5050	63.0F	7.7	340	--	--	--	--	--	--	--	--	--	--					
0935	0000	17.2C																	
08/16/82	5050	63.0F	7.8	350	39	10	16	8.9	158	--	5.0	--	.0	.3		139	0.6		
1545	5050	17.2C	8.3	348	1.95	.82	.70	.23	3.16		.14			--		0	1.1	S	
					53	22	19	6											
08/24/83	5050	60.0F	7.8	345	--	--	--	--	--	--	--	--	--	--					
0830	0000	15.5C																S	

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MINERAL ANALYSES OF GROUND WATER

DATE TIME	SAMPLER LAB	TEMP	FIELD LABORATORY PH EC	MINERAL CONSTITUENTS IN				MILLIGRAMS PER LITER MILLIEQUIVALENTS PER LITER PERCENT REACTANCE VALUE				MILLIGRAMS PER LITER				REN		
				CA	MG	NA	K	CACO3	SO4	CL	NO3	TURB	B	F	TDS SUM		TH MCH	SAR ASAR
A A-23 A-23.E A-23.E2 42N/12E-07M01 M		SACRAMENTO HB PITT RIVER HU UPPER PITT RIVER HA ALTURAS HSA																
06/04/58 0955	5050 9551	57.0F 13.9C	8.2 325	42 2.10 49	14 1.15 27	17 .74 17	10 .26 6	175 3.50 61	24 .50 12	8.3 .23 5	4.3 .07 2	.0 74.0	.4	299	160 0	0.6 1.1	C	
08/19/82 0745	5050 0000	55.0F 12.8C	7.1 465	-- --	-- --	-- --	-- --	-- --	-- --	-- --	-- --	-- --	-- --	-- --	-- --	-- --	-- --	-- --
08/25/83 1400	5050 5050	60.0F 15.5C	7.3 450 8.2	44 2.20 439	16 1.32	-- --	-- --	184 3.68	-- --	8.0 .23	-- --	.0 --	-- --	-- --	176 0	-- --	-- --	S
66 42N/12E-08E01 M																		
06/04/58 0920	5050 9551	62.0F 16.7C	8.4 250	36 1.80 52	11 .90 26	13 .57 17	7.2 .18 5	156 3.12 88	12 .25 7	5.6 .16 4	1.7 .03 1	.0 70.0	.3	250	134 0	0.5 0.9	C	
42N/12E-08K01 M																		
08/19/82 0725	5050 5050	59.0F 15.0C	7.3 380 7.4	20 1.00 28	5.0 .41 12	43 1.87 53	9.4 .24 7	87 1.74	-- --	40 1.13	-- --	-- --	-- --	-- --	70 0	2.2 2.9	S	
42N/12E-09F01 M																		
06/04/58 0855	5050 9551	62.0F 16.7C	8.2 280	21 1.05 29	17 1.40 38	21 .91 25	11 .28 8	153 3.06 82	21 .44 12	7.4 .21 6	2.7 .04 1	.02 78.0	.3	271	123 0	0.8 1.5	C	
42N/12E-10E01 M																		
06/04/58 0835	5050 9551	56.0F 13.3C	8.3 250	29 1.45 44	5.8 .48 15	25 1.09 33	9.6 .25 8	127 2.54 75	19 .40 12	13 .38 11	3.0 .05 1	.06 66.0	.3	247	95 0	1.1 1.8	C	
42N/12E-10H01 M																		
08/16/82 1605	5050 0000	66.0F 18.9C	7.3 300	-- --	-- --	-- --	-- --	-- --	-- --	-- --	-- --	-- --	-- --	-- --	-- --	-- --	-- --	-- --
08/24/83 0900	5050 5050	67.0F 19.4C	7.2 300 8.0	20 1.00 301	3.0 .25	-- --	-- --	121 2.42	-- --	9.0 .25	-- --	.2 --	-- --	-- --	62 0	-- --	-- --	S

MINERAL ANALYSES OF GROUND WATER

DATE TIME	SAMPLER LAB	TEMP	FIELD LABORATORY PH EC	MINERAL CONSTITUENTS IN				MILLIGRAMS PER LITER MILLIEQUIVALENTS PER LITER PERCENT REACTANCE VALUE				MILLIGRAMS PER LITER				REY			
				CA	MG	NA	K	CACD3	SD4	CL	NO3	TURB	F SID2	TDS SUM	TH NCH		SAR ASAR		
A A-23 A-23.E A-23.E2 42N/12E-11J01 M		SACRAMENTO HB PITT RIVER HU UPPER PITT RIVER HA ALTURAS HSA																	
08/07/67	5050	64.5F		40	13	18	8.1	157	20	9.7	8.2	.0	--	221	159	0.6			
1230	5050	18.0C	8.3 388	2.00	1.07	.78	.21	3.14	.42	.27	.13	--	--	211	0	1.2			
				49	26	19	5	79	11	7	3								
07/24/68	0000	64 F	7.4 395	--	--	--	--	--	--	--	--	--	--						
1405	5050	18 C																	
07/17/69	5050	67.0F	7.5 380	--	--	17	--	162	--	8.0	--	--	.3		151				
1530	5050	19.4C	7.8 365			.74		3.24		.23			--				S		
						20													
07/22/70	0000	64 F	7.5 380	--	--	--	--	--	--	--	--	--	--						
1540	5050	18 C															S		
07/28/71	5050	64 F	7.4 370	--	--	--	--	--	--	--	--	--	--						
0930	0000	18 C															S		
08/24/72	5050	63.0F	7.5 395	--	--	--	--	--	--	--	--	--	--						
1430	0000	17.2C															S		
07/31/73	5050	66.0F	7.4 370	--	--	--	--	--	--	8.2	9.3	--	--		149				
1400	5050	18.9C	379							.23	.15						S		
07/16/74	5050	63.0F	7.4 400	44	16	18	3.5	171	17	10	13.0	.0	--	281	176	0.6			
1240	5050	17.2C	8.2 411	2.20	1.32	.78	.09	3.42	.35	.28	.21	--	--	224	5	1.2	T		
				50	30	18	2	80	8	7	5								
08/12/75	5050	64.0F	7.4 392	--	--	--	--	--	--	--	--	--	--						
1130	0000	17.8C																	
08/26/76	5050	63.0F	7.5 420	--	--	--	--	--	--	--	--	--	--						
1500	0000	17.2C																	
06/29/77	5050	64.0F	7.4 400	42	10	20	6.3	162	19	9.0	8.8	.0	--	260	146	0.7			
1030	5050	17.8C	8.3 397	2.10	.82	.87	.16	3.24	.40	.25	.14	--	--	212	0	1.4			
				53	21	22	4	80	10	6	3								

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MINERAL ANALYSES OF GROUND WATER

DATE TIME	SAMPLER LAB	TEMP	FIELD LABORATORY PH EC	MINERAL CONSTITUENTS IN				MILLIGRAMS PER LITER MILLIEQUIVALENTS PER LITER				MILLIGRAMS PER LITER				REM
				CA	MG	NA	K	PERCENT REACTANCE VALUE				TDS SUM	TH NCM	SAR ASAR		
								CaCO3	SO4	CL	NO3				B TURB	

	A A-23 A-23.E A-23.E2 42N/12E-11J01 M		SACRAMENTO HB PITT RIVER HU UPPER PITT RIVER HA ALTURAS HSA													
08/22/78 0930	5050 0000	61.0F 16.1C	7.6 395	-- --	-- --	-- --	-- --	-- --								
										CONTINUED						
07/10/79 0955	5050 0000	63.0F 17.2C	7.3 380	-- --	-- --	-- --	-- --	-- --								S
08/13/80 1510	5050 0000	62.0F 16.7C	7.4 400	-- --	-- --	-- --	-- --	-- --								S
101 08/13/81 1200	5050 5050	65.0F	7.5 380	42	11	18	7.9	158						150	0.6	
		18.3C	8.1 372	2.10	.90	.78	.20	3.16		8.0					0	1.2
08/17/82 0900	5050 0000	64.0F 17.8C	7.4 390	-- --	-- --	-- --	-- --	-- --								S
08/24/83 1000	5050 0000	62.0F 16.7C	7.3 415	-- --	-- --	-- --	-- --	-- --								S
09/19/84 1345	5050 0000	66.0F 18.9C	7.8 325	-- --	-- --	-- --	-- --	-- --								S
42N/12E-11Q01 M																
07/29/60 0944	5050 5050			26	4.9	60	12	139	34	34	2.9	.68	.3		85	2.8
		8.3	458	1.30	.40	2.61	.31	2.78	.71	.96	.05		79.0	337	0	4.5
				28	9	56	7	62	16	21	1					
08/23/61 0845	5050 5050	74.0F		24	3.9	64	12	139	36	38	2.8	.76	.3		76	3.2
		23.3C	8.1 475	1.20	.32	2.78	.31	2.78	.75	1.07	.05		80.0	345	0	4.9
				26	7	60	7	60	16	23	1					
03/21/62 1310	5050 5050			39	10	18	7.7	156	15	6.0	6.8	.06	.3		139	0.7
		8.0	360	1.95	.82	.78	.20	3.12	.31	.17	.11		70.0	266	0	1.2
				52	22	21	5	84	8	5	3					

MINERAL ANALYSES OF GROUND WATER

DATE TIME	SAMPLER LAB	TEMP	FIELD		MINERAL CONSTITUENTS IN				MILLIGRAMS PER LITER				MILLIGRAMS PER LITER				REM
			LABORATORY						MILLIEQUIVALENTS PER LITER								
			PH	EC	CA	MG	NA	K	PERCENT REACTANCE VALUE				B	F	TDS	TH	
								CACO3	SO4	CL	NO3	TURB	SiO2	SUM	NCH	ASAR	
	A A-23 A-23.E A-23.E2 42N/12E-28G01 M		SACRAMENTO HB PITT RIVER HU UPPER PITT RIVER HA ALTURAS HSA														
08/19/82 1520	5050 0000	71.0F 21.6C	7.3	325	--	--	--	--	--	--	--	--	--	--			
08/25/83 1600	5050 5050	63.0F 17.2C	7.2 8.0	380 375	22 1.10	5.0 .41	-- --	-- --	129 2.58	--	22 .62	3.8 .06	.2 --	--		76 0	
	42N/12E-29C01 M																
08/19/82 1201	5050 5050	74.0F 23.3C	7.7 7.5	202 201	7.0 .35 18	1.0 .08 4	30 1.31 68	7.0 .18 9	74 1.48	--	9.0 .25	--	--	--		22 0	2.8 2.1
08/25/83 1110	5050 0000	66.0F 18.9C	7.6	205	--	--	--	--	--	--	--	--	--	--			
	42N/12E-29R01 M																
08/19/82 1500	5050 5050	67.0F 19.4C	7.4 7.5	215 207	7.0 .35 16	2.0 .16 8	33 1.44 68	7.1 .18 8	73 1.46	--	11 .31	--	--	--		26 0	2.8 2.3
08/25/83 1140	5050 0000	60.0F 15.5C	7.6	205	--	--	--	--	--	--	--	--	--	--			
	42N/13E-02H01 M																
07/19/56 0930	5050 5000	0 F 18 C	7.7	238	11 .55 22	17 1.40 55	7.2 .31 12	11 .28 11	124 2.48 96	1.0 .02 1	.5 .01 0	3.9 .06 2	.01 51.0	.0	177	99 0	0.3 0.5
	42N/13E-05G02 M																
08/16/82 1330	5050 5050	72.0F 22.2C	7.5 7.9	320 315	16 .80 24	4.0 .33 10	43 1.87 57	11 .28 9	136 2.72	--	6.0 .17	--	.0 --	--		56 0	2.5 3.5

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MINERAL ANALYSES OF GROUND WATER

DATE TIME	SAMPLER LAB	TEMP	FIELD		MINERAL CONSTITUENTS IN					MILLIGRAMS PER LITER				MILLIGRAMS PER LITER				REN
			LABORATORY		CA	MG	NA	K	PERCENT REACTANCE VALUE				TDS SUM	TH MCM	SAR ASAR			
			PH	EC					CACO3	SO4	CL	NO3				B TURB	F SIO2	
			SACRAMENTO HB															
			PITT RIVER HU															
			UPPER PITT RIVER HA															
			ALTURAS HSA															
06/04/58	5050	62.0F			37	11	20	10	159	22	.1	6.3	.02	.1	139	0.7		
1250	9551	16.7C	8.4	300	1.85	.90	.07	.26	3.18	.46	.00	.10		70.0	272	0	1.4	C
					48	23	22	7	85	12	0	3						
			42N/13E-06601 M															
06/04/58	5050	64.0F			39	8.2	20	10	150	21	8.7	6.5	.01	.2	132	0.8		
1220	9551	17.8C	8.2	280	1.95	.67	.07	.26	3.00	.44	.25	.10		58.0	261	0	1.4	C
					52	18	23	7	79	12	7	3						
			42N/13E-06603 M															
06/15/83	5050	58.0F	7.4	450	47	13	22	8.3	175	24	7.0	22.0	.0	--	302	171	0.7	E
0600	5050	14.4C	8.4	430	2.35	1.07	.96	.21	3.50	.50	.20	.35		--	248	0	1.4	
					51	23	21	5	77	11	4	8						
			42N/13E-06N01 M															
08/17/82	5050	66.0F	7.8	320	27	4.0	33	9.2	134	--	6.0	--	--	--	84	1.6		
0845	5050	18.9C	7.8	315	1.35	.33	1.44	.24	2.68		.17				0	2.5		
					40	10	43	7										
			42N/13E-06P01 M															
08/16/82	5050	62.0F	7.3	975	59	46	58	7.3	487	--	8.0	--	.1	--	336	1.4		
1440	5050	16.7C	8.4	938	2.94	3.78	2.52	.19	9.73		.23				0	3.7		
					31	40	27	2										
06/14/83	5050	53.0F	7.4	1100	66	52	59	7.8	469	72	7.0	27.0	.2	--	575	379	1.3	
1200	5050	11.7C	8.3	959	3.29	4.28	2.57	.20	9.37	1.50	.20	.44		--	572	0	3.5	S
					32	41	25	2	81	13	2	4						
			42N/13E-17001 M															
06/03/58	5050	57.0F			23	8.7	20	6.2	120	13	8.7	4.8	.03	.3	94	0.9		
1400	9551	13.9C	8.3	220	1.15	.72	.87	.16	2.40	.27	.25	.08		68.0	224	0	1.4	C
					40	25	30	6	80	9	8	3						
08/17/82	5050	59.0F	7.1	325	28	10	26	5.9	138	--	8.0	--	--	--	111	1.1		
1105	5050	15.0C	8.0	333	1.40	.82	1.13	.15	2.76		.23				0	1.8		
					40	23	32	4										

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MINERAL ANALYSES OF GROUND WATER

DATE TIME	SAMPLER LAB	TEMP	FIELD LABORATORY PH EC	MINERAL CONSTITUENTS IN				MILLIGRAMS PER LITER MILLIEQUIVALENTS PER LITER				MILLIGRAMS PER LITER				REMARKS
				CA	MG	NA	K	PERCENT CACO3	REACTANCE SO4	VALUE CL	NO3	TURB	B F	TDS SUM	TH NCH	

	A A-23 A-23.E A-23.E2 42N/13E-17G01 M		SACRAMENTO HB PITT RIVER HU UPPER PITT RIVER HA ALTURAS HSA													
08/17/82	5050	61.0F	7.5	330	33	12	14	4.9	133	--	9.0	--	--	--	132	0.5
1135	5050	16.1C	7.9	322	1.65	.99	.61	.13	2.66		.25				0	0.9
					49	29	18	4								S
08/24/83	5050	59.0F	7.4	338	--	--	--	--	--	--	--	--	--	--		
1045	0000	15.0C														S
	42N/13E-17L02 M															
08/17/82	5050	63.0F	7.6	365	36	12	20	6.5	154	--	10	--	.0	--	140	0.7
1206	5050	17.2C	8.0	364	1.80	.99	.87	.17	3.08		.28				0	1.4
					47	26	23	4								S
08/24/83	5050	61.0F	7.4	370	--	--	--	--	--	--	--	--	--	--		
1120	0000	16.1C														S
	42N/13E-18Q01 M															
08/18/82	5050	50.0F	7.3	295	--	--	--	--	--	--	--	--	--	--		
0800	0000	10.0C														S
	42N/13E-19B01 M															
08/18/82	5050	57.0F	7.7	395	--	--	--	--	--	--	--	--	--	--		
0745	0000	13.9C														S
	42N/13E-20B02 M															
08/17/82	5050	62.0F	7.4	290	27	8.0	19	6.6	120	--	7.0	--	--	--	101	0.8
1320	5050	16.7C	7.8	292	1.35	.66	.83	.17	2.40		.20				0	1.3
					45	22	28	6								S
	42N/13E-20E01 M															
08/17/82	5050	64.0F	7.7	300	27	8.0	22	6.7	124	--	8.0	--	--	--	101	1.0
1430	5050	17.8C	8.1	300	1.35	.66	.96	.17	2.48		.23				0	1.5
					43	21	31	5								S

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MINERAL ANALYSES OF GROUND WATER

DATE TIME	SAMPLER LAB	TEMP	FIELD LABORATORY PH EC	MINERAL CONSTITUENTS IN				MILLIGRAMS PER LITER MILLIEQUIVALENTS PER LITER				MILLIGRAMS PER LITER				REN		
				CA	MG	NA	K	PERCENT REACTANCE VALUE				TDS SUM	TH NCM	SAR ASAR				
								CACO3	SO4	CL	NO3				B TURB		F SIO2	

A A-23 A-23.E A-23.E2 42N/13E-21B01 M																		
SACRAMENTO HB PITT RIVER HU UPPER PITT RIVER HA ALTURAS HSA																		
06/14/83	5050	61.0F	7.5	640	65	21	30	9.2	152	120	31	4.2	.0	--	442	249	0.8	E
1255	5050	16.1C	8.3	620	3.24 50	1.73 27	1.31 20	.24 4	3.04 47	2.50 39	.87 13	.07 1	--	--	372	97	1.7	
42N/13E-21K02 M																		
08/17/82	5050	62.0F	7.5	350	32	0.0	25	8.2	131	--	8.0	--	--	--	113	1.0		S
1350	5050	16.7C	8.1	345	1.60 45	.66 19	1.09 31	.21 6	2.62		.23				0	1.7		
42N/13E-22D01 M																		
06/04/58	5050	58.0F			19	4.8	16	7.2	93	12	6.5	--	.0	.1	68	0.8		
1400	9551	14.4C	8.2	190	.95 43	.39 18	.70 32	.18 8	1.86	.25	.18		.0	65.0	187	0	1.1	S
42N/13E-28K01 M																		
06/05/58	5050	59.0F			39	19	16	5.0	167	7.0	18	13.0	.0	.2	176	0.5		
0735	9551	15.0C	8.4	350	1.95 45	1.56 36	.70 16	.13 3	3.34 79	.15 4	.51 12	.21 5	.0	64.0	281	9	1.0	C
42N/13E-30C01 M																		
06/03/58	5050	65.0F			17	1.2	34	7.2	107	15	7.6	3.6	.19	.2	47	2.2		
1250	9551	18.3C	8.4	200	.85 33	.10 4	1.48 37	.18 7	2.14 79	.31 11	.21 8	.06 2		68.0	218	0	2.7	C
42N/13E-30C02 M																		
08/18/82	5050	70.0F	7.7	350	20	3.0	50	8.3	126	--	16	--	--	--	62	2.8		
0900	5050	21.1C	7.8	360	1.00 27	.25 7	2.18 60	.21 6	2.52		.45				0	3.9		S
42N/13E-31G01 M																		
06/03/58	5050	59.0F			22	5.1	105	12	297	6.7	2.0	--	.17	.4	76	5.2		
1110	9551	15.0C	8.0	420	1.10 17	.42 7	4.57 71	.31 5	5.93	.14	.06			76.0	407	0	9.6	S
42N/13E-31G02 M																		
08/22/59	5050	62.0F			19	6.7	105	12	312	6.6	4.1	.2	.28	.3	75	5.3		
1610	5050	16.7C	8.2	576	.95 15	.55 9	4.57 72	.31 5	6.23 96	.14 2	.12 2	.00 0		80.0	421	0	9.7	

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MINERAL ANALYSES OF GROUND WATER

DATE TIME	SAMPLER LAB	TEMP	FIELD LABORATORY PH EC	MINERAL CONSTITUENTS IN				MILLIGRAMS PER LITER MILLIEQUIVALENTS PER LITER PERCENT REACTANCE VALUE				MILLIGRAMS PER LITER				RE4		
				CA	MG	NA	K	CACO3	SO4	CL	NO3	TURB	SI02	TDS SUM	TH NCH		SAR ASAR	
A A-23 A-23.E A-23.E2 42N/13E-316D1 M		SACRAMENTO HB PITT RIVER HU UPPER PITT RIVER HA ALTURAS HSA				CONTINUED												
07/29/60	5050	63.0F			20	7.8	102	11	299	6.7	3.7	2.9	.27	.4		82	4.9	
0715	5050	17.2C	8.2	587	1.00	.64	4.44	.28	5.97	.14	.10	.05		80.0	414	0	9.1	
					16	10	70	4	95	2	2	1						
08/24/61	5050	61.0F			22	5.1	101	10	293	5.3	3.0	.4	.28	.3		76	5.0	
0905	5050	16.1C	8.3	564	1.10	.42	4.39	.26	5.85	.11	.08	.01		79.0	402	0	9.2	
					18	7	71	4	97	2	1	0						
08/28/62	5050				23	8.1	96	11	301	.5	5.3	.0	.0	.1	354	91	4.4	
0920	5050		8.4	530	1.15	.67	4.18	.28	6.01	.01	.15	.00		13.0	337	0	8.4	
					18	11	67	4	97	0	2	0						
09/10/63	5050				19	6.7	102	12	294	6.1	3.8	1.2	.3	--	404	75	5.1	
1230	5050		8.2	580	.95	.55	4.44	.31	5.87	.13	.11	.02		--	327	0	9.3	
					15	9	71	5	96	2	2	0						
08/25/64	5050				--	--	103	--	308	--	3.7	--	--	--		78		
1255	5050		8.5	582			4.48		6.15		.10							
							74											
03/12/65	5050				--	--	106	--	--	--	--	--	--	--		72		
	5050			550			4.61											
							76											
08/29/66	0000				--	--	--	--	--	--	--	--	--	--				
	0000			553														
08/07/67	5050	61.5F			--	--	105	--	--	--	6.7	--	--	--		91		
1302	5050	16.4C	8.6	591			4.57				.19							
							72											
07/24/68	0000	61 F	7.3	600	--	--	--	--	--	--	--	--	--	--				
1235	5050	16 C																
07/14/69	0000	66.0F	7.1	585	--	--	--	--	--	--	--	--	--	--				
1245	5050	18.9C																
07/22/70	5050	62 F	7.1	545	--	--	107	--	302	--	5.3	--	--	--		82		
1030	5050	17 C	8.6	562			4.65		6.03		.15							
							74											

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MINERAL ANALYSES OF GROUND WATER

DATE TIME	SAMPLER LAB	TEMP	FIELD LABRATORY		MINERAL CONSTITUENTS IN					MILLIGRAMS PER LITER MILLIEQUIVALENTS PER LITER				MILLIGRAMS PER LITER				RE4	
			PH	EC	CA	MG	NA	K	CACO3	SO4	CL	NO3	TURB	B	F	TDS SUM	TH NCH		SAR ASAR
	A A-23 A-23.E A-23.E2 42N/13E-31601 M		SACRAMENTO HB PITT RIVER HU UPPER PITT RIVER HA ALTURAS HSA																
07/28/71 0855	5050 0000	61 F 16 C	7.3	570	--	--	--	--	--	--	--	--							
08/24/72 1445	5050 0000	61.0F 16.1C	7.1	600	--	--	--	--	--	--	--	--							
08/02/73 0745	5050 0000	65.0F 18.3C	7.1	560	--	--	--	--	--	--	--	--							
07/18/74 0750	5050 0000	60.0F 15.5C	7.1	550	--	--	--	--	--	--	--	--							
08/14/75 1240	5050 0000	61.0F 16.1C	7.1	580	--	--	--	--	--	--	--	--							
08/24/76 1130	5050 0000	60.0F 15.5C	7.2	565	--	--	--	--	--	--	--	--							
08/02/77 1450	5050 5050	70.0F 21.1C	7.0 8.8	580 579	20 1.00 16	6.0 .49 8	104 4.52 72	10 .26 4	303 6.05 96	6.0 .12 2	4.0 .11 2	.3 .00 0	.2	-- -- --	380 332	74 0	5.3 9.6		
09/22/78 1030	5050 0000	59.0F 15.0C	7.2	545	--	--	--	--	--	--	--	--							
07/10/79 1015	5050 0000	58.0F 14.4C	7.1	560	--	--	--	--	--	--	--	--							
08/13/80 1400	5050 0000	62.0F 16.7C	7.1	595	--	--	--	--	--	--	--	--							
08/13/81 1215	5050 0000	62.0F 16.7C	7.0	585	--	--	--	--	--	--	--	--							

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MINERAL ANALYSES OF GROUND WATER

DATE TIME	SAMPLER LAB	TEMP	FIELD LABORATORY PH	EC	MINERAL CONSTITUENTS IN				MILLIGRAMS PER LITER MILLIEQUIVALENTS PER LITER PERCENT REACTANCE VALUE				MILLIGRAMS PER LITER				REM	
					CA	MG	NA	K	CAC03	SO4	CL	NO3	TURB	F	TDS SUM	TH MCH		SAR ASAR

	A A-23 A-23.E A-23.E2 42N/13E-31G01 M		SACRAMENTO HB PITT RIVER HU UPPER PITT RIVER HA ALTURAS HSA								CONTINUED							
08/19/82	5050	61.0F	7.1	575	21	7.0	98	11	296	--	3.0	--	--	--	82	4.7		
1225	5050	16.1C	8.7	546	1.05	.58	4.26	.28	5.91		.08				0	8.8		
					17	9	69	5										
08/24/83	5050	62.0F	7.2	555	--	--	--	--	--	--	--	--	--	--				
1340	0000	16.7C																
	42N/13E-31H01 M																	
08/18/82	5050	60.0F	7.2	400	32	10	42	6.5	202	--	5.0	--	--	--	121	1.7		
0940	5050	15.5C	8.2	400	1.60	.82	1.83	.17	4.04		.14				0	3.1		
					36	19	41	4										
	42N/13E-31P02 M																	
08/18/82	5050	80.0F	8.0	600	8.0	1.0	113	9.2	110	--	66	--	2.3	--	24	10.0		
0925	5050	26.6C	8.0	599	.40	.08	4.92	.24	2.20		1.86				0	9.1		
					7	1	87	4										
	42N/13E-32C02 M																	
08/18/82	5050	56.0F	7.2	500	31	16	27	8.9	276	--	1.0	--	--	--	144	1.0		
1000	5050	13.3C	8.3	485	1.55	1.32	1.17	.23	5.51		.03				0	2.1		
					36	31	27	5										
	42N/13E-32G01 M																	
06/03/58	5050	54.0F			33	11	24	6.0	180	5.6	3.7	--	.01	.3	128	0.9		
1130	9551	12.2C	8.1	255	1.65	.90	1.04	.15	3.60	.12	.10			52.0	243	0		
					44	24	28	4										
08/25/59	5050	62.0F			19	6.7	105	12	312	6.6	4.1	.2	.3	.3	421	75		
	5050	16.7C	8.2	576	.95	.55	4.57	.31	6.23	.14	.12	.00	.3	.3	421	0		
					15	9	72	5	96	2	2	0	80.0	421	0	9.7		
08/27/59	5050	56.0F			32	11	29	6.5	187	4.8	3.9	.2	.0	.2	255	125		
	5050	13.3C	8.0	364	1.60	.90	1.26	.17	3.74	.10	.11	.00		55.0	255	0		
					41	23	32	4	95	3	3	0				2.1		
07/29/60	5050	59.0F			33	11	29	5.5	184	5.6	3.7	.4	.03	.3	127	1.1		
0730	5050	15.0C	8.2	354	1.65	.90	1.26	.14	3.68	.12	.10	.01		57.0	256	0		
					42	23	32	4	94	3	3	0				2.1		
08/24/61	5050	55.0F			33	10	24	5.7	179	4.3	3.0	.5	.05	.2	124	0.9		
0920	5050	12.8C	8.4	353	1.65	.82	1.04	.15	3.58	.09	.08	.01		57.0	245	0		
					45	22	28	4	95	2	2	0				1.7		

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MINERAL ANALYSES OF GROUND WATER

DATE TIME	SAMPLER LAB	TEMP	FIELD LABORATORY PH EC	MINERAL CONSTITUENTS IN				MILLIGRAMS PER LITER MILLIEQUIVALENTS PER LITER PERCENT REACTANCE VALUE				MILLIGRAMS PER LITER				REN		
				CA	MG	NA	K	CACO3	SO4	CL	NO3	TURB	SIO2	TDS SUM	TH MCH		SAR ASAR	

	A A-23 A-23.E A-23.E2 42N/13E-32G01 M		SACRAMENTO HB PITT RIVER HU UPPER PITT RIVER HA ALTURAS HSA															
08/28/62	5050																	
0915	5050			0.4	340	1.70	.70	1.35	.14	3.58	.10	.10	.00	.1	.2	228	71	1.6
						44	18	35	4	95	3	3	0			248	0	2.6
09/10/63	5050																	
1240	5050			0.1	367	1.60	.90	1.17	.17	3.60	.09	.08	.01	.1	--	249	124	1.1
						42	23	30	4	95	2	2	0			193	0	2.0
08/25/64	5050																	
1310	5050			0.4	368	--	--	28	--	183	--	3.4	--	--	--		126	
								1.22		3.66		.10						
								33										
08/12/65	5050																	
	5050																123	
08/29/66	0000																	
	5050																	
08/02/67	5050																	
1330	5050			0.5	371	--	--	29	--	--	--	3.7	--	--	--		124	
								1.26				.10						
								34										
07/24/68	0000	54 F	7.5	370	--	--	--	--	--	--	--	--	--	--	--			
1220	5050	12 C																
07/14/69	5050	57.0F	7.4	378	33	9.8	29	6.3	179	5.8	3.6	.6	.0	--	224	123	1.1	
1310	5050	13.9C	8.0	342	1.65	.81	1.26	.16	3.58	.12	.10	.01	--	--	195	0	2.1	
					43	21	32	4	94	3	3	0						
07/22/70	0000	60 F	7.5	360	--	--	--	--	--	--	--	--	--	--				
1035	5050	16 C																
07/28/71	5050	63 F	7.4	355	--	--	--	--	--	--	--	--	--	--				
0900	0000	17 C																
08/24/72	5050	59.0F	7.1	375	--	--	--	--	--	--	--	--	--	--				
1455	0000	15.0C																

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MINERAL ANALYSES OF GROUND WATER

DATE TIME	SAMPLER LAB	TEMP	FIELD LABORATORY PH EC	MINERAL CONSTITUENTS IN				MILLIGRAMS PER LITER MILLIEQUIVALENTS PER LITER				MILLIGRAMS PER LITER				REMARKS		
				CA	MG	NA	K	PERCENT REACTANCE VALUE				B	F	TDS SUM	TH MCH		SAR ASAR	
								CACO3	SO4	CL	NO3							TURB
A A-23 A-23.E A-23.E2 42N/13E-32601 M		SACRAMENTO HB PITT RIVER HU UPPER PITT RIVER HA ALTURAS HSA				CONTINUED												
08/03/73 0755	5050 5050	69.0F 20.5C	7.3 375 366	-- -- --	-- -- --	-- -- --	-- -- --	-- -- --	-- -- --	4.8 .14	-- --	-- --	-- --	126		S		
07/18/74 0800	5050 0000	62.0F 16.7C	7.6 350	-- --	-- --	-- --	-- --	-- --	-- --	-- --	-- --	-- --	-- --			S		
08/14/75 1255	5050 0000	58.0F 14.4C	7.4 360	-- --	-- --	-- --	-- --	-- --	-- --	-- --	-- --	-- --	-- --			S		
08/24/76 1120	5050 0000	62.0F 16.7C	7.5 360	-- --	-- --	-- --	-- --	-- --	-- --	-- --	-- --	-- --	-- --			S		
08/02/77 1500	5050 5050	59.0F 15.0C	7.4 375 369	32 1.60 41	11 .90 23	29 1.26 32	4.8 .12 3	181 3.62 96	4.0 .08 2	3.0 .08 2	.7 .01 0	.0 --	281 193	125 0	1.1 2.1	E T		
08/22/78 1045	5050 0000	58.0F 14.4C	7.5 355	-- --	-- --	-- --	-- --	-- --	-- --	-- --	-- --	-- --	-- --			S		
07/10/79 1030	5050 0000	62.0F 16.7C	7.5 360	-- --	-- --	-- --	-- --	-- --	-- --	-- --	-- --	-- --	-- --			S		
08/13/80 1415	5050 0000	59.0F 15.0C	7.3 375	-- --	-- --	-- --	-- --	-- --	-- --	-- --	-- --	-- --	-- --			S		
08/13/81 1205	5050 0000	70.0F 21.1C	7.6 365	-- --	-- --	-- --	-- --	-- --	-- --	-- --	-- --	-- --	-- --			S		
08/19/82 1215	5050 5050	68.0F 20.0C	7.5 360 352	33 1.65 42	11 .90 23	28 1.22 31	6.0 .15 4	178 3.56	-- --	4.0 .11	-- --	-- --	-- --	128 0	1.1 2.0	S		
08/24/83 1400	5050 0000	64.0F 17.8C	7.3 370	-- --	-- --	-- --	-- --	-- --	-- --	-- --	-- --	-- --	-- --			S		

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MINERAL ANALYSES OF GROUND WATER

DATE TIME	SAMPLER LAB	TEMP	FIELD LABORATORY		MINERAL CONSTITUENTS IN					MILLIGRAMS PER LITER MILLIEQUIVALENTS PER LITER PERCENT REACTANCE VALUE				MILLIGRAMS PER LITER				RE4
			PH	EC	CA	MG	NA	K	CACO3	SO4	CL	NO3	TURB	F SID2	TDS SUM	TH NCH	SAR ASAR	

A A-23 A-23.E A-23.E2 42N/13E-33J01 M SACRAMENTO HB PITT RIVER HU UPPER PITT RIVER HA ALTURAS MSA																		
08/18/82	5050	59.0F	7.3	80	7.0	2.0	4.0	2.2	37	--	.0	--	--	--		26	0.3	
1020	5050	15.0C	7.1	76	.35	.16	.17	.06	.74		.00					0	0.2	
42N/13E-34K01 M																		
06/05/58	5050	56.0F			20	11	14	6.6	126	1.5	4.5	--	.0	.2		95	0.6	
0940	9551	13.3C	8.3	210	1.00	.90	.61	.17	2.52	.03	.13		57.0		191	0	1.0	
43N/13E-14H01 M																		
08/16/82	5050	69.0F	7.0	135	10	3.0	11	3.8	50	--	3.0	--	--	--		38	0.8	
1415	5050	20.5C	7.2	136	.50	.25	.48	.10	1.00		.08					0	0.7	
43N/13E-32Q01 M																		
08/17/82	5050	71.0F	7.8	300	--	--	--	--	--	--	--	--	--	--				
0750	0000	21.6C																
44N/13E-25H01 M																		
07/29/58	5050	56.0F			28	7.8	10	2.1	105	1.6	3.7	15.0	.1	.2	188	102	0.4	
	5050	13.3C	8.0	248	1.40	.64	.44	.05	2.10	.03	.10	.24		57.0	188	0	0.7	
44N/13E-36A01 M																		
07/29/58	5050	60.0F			15	1.3	23	2.3	83	5.6	3.7	2.0	.1	.2	131	43	1.5	
	5050	15.5C	8.0	189	.75	.11	1.00	.06	1.66	.12	.10	.03		29.0	132	0	1.7	
07/29/60	5050				13	2.3	23	2.0	82	6.2	4.7	1.4	.06	.1		42	1.5	
0720	5050		8.0	184	.65	.19	1.00	.05	1.64	.13	.13	.02		30.0	132	0	1.7	
08/24/61	5050	64.0F			13	2.6	22	1.8	82	4.1	1.0	9.2	.14	.3		43	1.5	
0705	5050	17.8C	8.0	184	.65	.21	.96	.05	1.64	.09	.03	.15		31.0	134	0	1.6	
08/29/62	5050				16	1.6	25	1.7	87	1.0	3.5	1.0	.1	.1	114	46	1.6	
0815	5050		8.0	197	.80	.13	1.09	.04	1.74	.02	.10	.02		28.0	130	0	1.8	

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MINERAL ANALYSES OF GROUND WATER

DATE TIME	SAMPLER LAB	TEMP	FIELD LABORATORY PH EC	MINERAL CONSTITUENTS IN				MILLIGRAMS PER LITER MILLIEQUIVALENTS PER LITER				MILLIGRAMS PER LITER				REMARKS		
				CA	MG	NA	K	PERCENT REACTANCE VALUE				TDS SUM	TH NCH	SAR ASAR				
								CaCO3	SO4	CL	NO3				TURB		SI02	
A A-23 A-23.E A-23.E2 44N/13E-36A01 M		SACRAMENTO HB PITT RIVER HU UPPER PITT RIVER HA ALTURAS HSA				CONTINUED												
09/11/63	5050			11	2.8	25	1.9	84	3.8	3.5	1.9	.1	.1	120	39	1.7	E	
0635	5050	7.9	175	.55	.23	1.09	.05	1.68	.08	.10	.03		21.0	121	0	1.9		
				29	12	57	3	89	4	5	2							
08/ /64	5050			--	--	24	--	81	--	3.6	--	--	--		42			
	5050	8.3	185			1.04		1.62		.10							S	
						55												
08/12/65	5050			--	--	25	--	--	--	--	--	--	--		41			
	5050		185			1.09											S	
						57												
08/08/67	5050	60.0F		--	--	25	--	82	--	4.0	--	--	--		42			
0800	5050	15.5C	8.2	190		1.09		1.64		.11							S	
						56												
07/24/68	0000	65.0F	8.3	200	--	--	--	--	--	--	--	--	--					
1440	5050	18.3C																
07/15/69	5050	66.0F	8.3	190	--	--	23	--	--	--	--	--	--		42			
0750	5050	18.9C		191		1.00											S	
						54												
07/20/70	0000	69 F	8.3	190	--	--	--	--	--	--	--	--	--					
1115	5050	21 C																
07/27/71	5050	67 F	8.1	190	--	--	--	--	--	--	--	--	--					
0740	0000	19 C																
08/25/72	5050	60.0F	7.9	200	--	--	--	--	--	--	--	--	--					
0725	0000	15.5C																
07/31/73	5050	64.0F	8.3	210	--	--	--	--	--	3.3	--	--	--		51			
1440	5050	17.8C		202						.09							S	
07/16/74	5050	60.0F	8.3	200	--	--	--	--	--	--	--	--	--					
1305	0000	15.5C															S	

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MINERAL ANALYSES OF GROUND WATER

DATE TIME	SAMPLER LAB	TEMP	FIELD		MINERAL CONSTITUENTS IN					MILLIGRAMS PER LITER				MILLIGRAMS PER LITER				RE4
			LABORATORY		CA	MG	NA	K	PERCENT REACTANCE VALUE				TURB	F	TDS	TH	SAR	
			PH	EC					CAO3	SO4	CL	NO3						

	A A-23 A-23.E A-23.E2 44N/13E-36A01 M		SACRAMENTO HB PITT RIVER HU UPPER PITT RIVER HA ALTURAS HSA															
06/29/77	5050	63.0F	7.1	180	18	6.0	6.0	2.8	82	.0	.5	.4	.0	--	127	70	0.3	E
1210	5050	17.2C	8.1	168	.90	.49	.26	.07	1.64	.00	.01	.01	--	83	0	0.4	T	
					52	28	15	4	99	0	1	1						
08/22/78	5050	58.0F	7.4	180	--	--	--	--	--	--	--	--	--	--				
1120	0000	14.4C																S
07/10/79	5050	58.0F	7.7	130	14	4.0	6.0	--	65	--	.0	--	--	--		52	0.4	
1110	5050	14.4C	8.1	132	.70	.33	.26	--	1.30	--	.00	--	--	--		0	0.4	S
					54	26	20											
08/12/80	5050	63.0F	8.3	205	--	--	--	--	--	--	--	--	--	--				
1120	0000	17.2C																
	44N/13E-36B01 M																	
07/29/58	5050	62.0F			24	7.5	22	3.2	105	16	12	2.6	.1	.3	209	91	1.0	E
	5050	16.7C	8.0	287	1.20	.62	.96	.08	2.10	.33	.34	.04		58.0	208	0	1.5	
					42	22	34	3	75	12	12	1						
	44N/14E-07K01 M																	
07/29/60	5050	56.0F			67	26	29	1.3	210	16	30	87.0	.03	.2		274	0.8	
0745	5050	13.3C	8.4	634	3.34	2.14	1.26	.03	4.20	.33	.85	1.40		58.0	440	64	1.7	
					49	32	19	0	62	5	13	21						
08/29/62	5050				45	18	24	1.3	195	7.6	10	26.0	.06	.2	288	188	0.8	
1145	5050		8.4	446	2.25	1.48	1.04	.03	3.90	.16	.28	.42		50.0	299	0	1.6	
					47	31	22	1	82	3	6	9						
09/11/63	5050				39	16	23	1.3	181	5.8	6.0	17.0	.1	.1	272	163	0.8	E
0645	5050		8.4	380	1.95	1.32	1.00	.03	3.62	.12	.17	.27		40.0	257	0	1.5	
					45	31	23	1	87	3	4	6						
08/26/64	5050				41	18	22	1.7	184	11	9.1	22.0	.0	--	290	177	0.7	
0735	5050		7.8	433	2.05	1.48	.96	.04	3.68	.23	.26	.35		--	235	0	1.4	
					45	33	21	1	81	5	6	8						
08/12/65	5050				--	--	39	--	--	--	--	--	--	--		267		
	5050			822			1.70											S
							24											

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MINERAL ANALYSES OF GROUND WATER

DATE TIME	SAMPLER LAB	TEMP	FIELD LABORATORY PH EC	MINERAL CONSTITUENTS IN				MILLIGRAMS PER LITER MILLIEQUIVALENTS PER LITER				MILLIGRAMS PER LITER				REM	
				CA	MG	NA	K	PERCENT REACTANCE VALUE				B	F	TDS SUM	TH MCH		SAR ASAR
								CACO3	SO4	CL	NO3						
A A-23 A-23.E A-23.E2 44N/14E-07K01 M		SACRAMENTO HB PITT RIVER HU UPPER PITT RIVER HA ALTURAS HSA				CONTINUED											
08/31/66	5050			38	14	21	1.6	178	2.3	4.4	4.2	.0	--	201	151	0.7	
1120	5050		8.6 366	1.90	1.15	.91	.04	3.56	.05	.12	.07		--	192	0	1.4	S
				48	29	23	1	94	1	3	2						
08/08/67	5050	54.0F		--	--	--	--	--	--	--	--	--	--				
0830	5050	12.2C	389														
07/25/68	5050	54 F	7.1	465	--	--	25	--	191	--	10	--	--		186		
1100	5050	12 C	8.3	476			1.09		3.82		.28						S
							23										
07/19/69	5050	55.0F	7.1	850	86	36	38	1.4	247	35	42	123	.1	--	571	363	0.9
0830	5050	12.8C	8.2	830	4.29	2.96	1.65	.04	4.94	.73	1.18	1.98	--	510	116	2.1	
					48	33	18	0	56	8	13	22					
07/20/70	5050	55 F	7.1	410	41	16	22	1.0	181	7.4	6.7	21.0	.0	--	261	166	0.7
1145	5050	13 C	7.3	395	2.05	1.32	.96	.03	3.62	.15	.19	.34	--	224	0	1.5	
					47	30	22	1	84	3	4	8					
07/27/71	5050	54 F	7.1	485	--	--	--	--	--	--	--	--	--				
0830	0000	12 C															S
08/25/72	5050	55.0F	7.0	560	--	--	--	--	--	--	--	--	--				
0740	0000	12.8C															S
07/31/73	5050	58.0F	7.0	480	--	--	--	--	--	--	--	--	--				
1455	0000	14.4C															S
07/16/74	5050	60.0F	6.9	385	--	--	--	--	--	--	--	--	--				
1335	0000	15.5C															S
08/12/75	5050	57.0F	7.0	750	73	26	38	1.3	276	27	20	59.0	.1	--	460	291	1.0
1235	5050	13.9C	8.6	673	3.64	2.14	1.65	.03	5.51	.56	.56	.95	--	410	14	2.3	
					49	29	22	0	73	7	7	13					
08/24/76	5050	57.0F	6.9	680	--	--	--	--	--	--	--	--	--				
1300	0000	13.9C															S

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MINERAL ANALYSES OF GROUND WATER

DATE TIME	SAMPLER LAB	TEMP	FIELD LABORATORY PH EC	MINERAL CONSTITUENTS IN				MILLIGRAMS PER LITER				MILLIGRAMS PER LITER				REM	
				CA	MG	NA	K	MILLIEQUIVALENTS PER LITER				PERCENT REACTANCE VALUE					
				CA	MG	NA	K	CaCO3	SO4	CL	NO3	TURB	SiO2	TDS SUM	TH NCH	SAR ASAR	
				SACRAMENTO HB				CONTINUED									
				PITT RIVER HU													
				UPPER PITT RIVER MA													
				ALTURAS HSA													
06/29/77	5050	56.0F	6.8	705	--	--	--	--	--	--	--	--	--	--	--	--	S
1225	0000	13.3C															
07/10/79	5050	59.0F	7.1	630	60	24	--	--	246	--	16	--	.1	--		248	S
1120	5050	15.0C	8.6	588	2.99	1.97			4.92		.45					2	
08/12/80	5050	60.0F	7.0	625	--	--	--	--	--	--	--	--	--	--	--	--	S
1135	0000	15.5C															
09/11/81	5050	62.0F	6.9	380	--	--	--	--	--	--	--	--	--	--	--	--	S
1055	0000	16.7C															
08/17/82	5050	61.0F	7.0	400	--	--	--	--	--	--	--	--	--	--	--	--	S
1030	0000	16.1C															
08/24/83	5050	59 F	7.1	700	73	29	--	--	292	--	19	48.0	--	--		301	S
1305	5050	15 C	7.8	690	3.64	2.38			5.83		.54	.77				10	
				44N/14E-07K02 M													
08/24/81	5050	57.0F			41	14	18	1.2	176	4.0	5.8	1.9	.09	.1		161	0.6
0730	5050	13.9C	7.9	386	2.05	1.15	.78	.03	3.52	.08	.16	.03		29.0	221	0	1.2

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APPENDIX D
MINOR ELEMENT ANALYSIS OF GROUND WATER

MINOR ELEMENT ANALYSES OF GROUND WATER

DATE TIME	SAMP LAB	DEPTH	DISCH EC	TEMP PH	ARSENIC	CONSTITUENTS IN MILLIGRAMS PER LITER		COPPER IRON	LEAD MANGANESE	MERCURY SELENIUM	SILVER ZINC	REM
* * *	* * *	* * *	* * *	* * *	* * *	BARIUM CADMIUM	CHROM (ALL) CHROM (HEX)	* * *	* * *	* * *	* * *	* * *
	A					SACRAMENTO HB						
	A-23					PITT RIVER HU						
	A-23.E					UPPER PITT RIVER HA						
	A-23.E1					CANBY HSA						
07/29/60	5050											
0915	5050				--	--	--	0.00	D	--	--	--
07/29/60	5050				0.00	D	--	0.00	D	0.00	D	--
0916	5050				0.00	D	0.00	0.17	T	0.00	D	0.03 D
	41N/09E-02A01	M										
08/05/58	5050			60.0F	--	--	--	0.06	D	--	--	--
	5050				--	--	--	0.06	D	--	--	--
	41N/09E-10C02	M										
08/05/58	5050			55.0F	--	--	--	--		--	--	--
1140	5050				--	--	--	0.03	T	--	--	--
	41N/09E-13E01	M										
08/07/58	5050			64.0F	--	--	--	--		--	--	--
0940	5050				--	--	--	0.00	T	--	--	--
	41N/10E-02N02	M										
08/07/58	5050			65.0F	--	--	--	--		--	--	--
0810	5050				--	--	--	0.63	T	--	--	--
08/28/62	5050				0.00	D	--	0.00	D	0.00	D	--
1100	5050				0.00	D	--	0.00	T	0.07	D	0.09 D
	41N/10E-11B01	M										
08/07/58	5050			72.0F	--	--	--	--		--	--	--
0830	5050				--	--	--	0.00	T	--	--	--
	41N/11E-01A01	M										
08/05/58	5050			64.0F	--	--	--	--		--	--	--
0750	5050				--	--	--	0.00	T	--	--	--

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MINOR ELEMENT ANALYSES OF GROUND WATER

DATE TIME	SAMP LAB	DEPTH	DISCH EC	TEMP PH	ARSENIC	BARIUM	CADMIUM	CHROM (ALL)	CHROM (HEX)	COPPER	IRON	LEAD	MANGANESE	MERCURY	SELENIUM	SILVER	ZINC	REM
			A		SACRAMENTO HB													
			A-23		PITT RIVER HU													
			A-23.E		UPPER PITT RIVER HA													
			A-23.E1		CANBY HSA													
			41N/11E-01F01 M		CONTINUED													
08/07/67	5050			80.5F	0.01	D	--	--	--	--	--	--	--	--	--	--	--	--
			41N/11E-02G01 M															
08/04/58	5050			62 F	--	--	--	--	--	0.00	T	--	--	--	--	--	--	--
			41N/11E-02J01 M															
08/04/58	5050			64.0F	--	--	--	--	--	0.04	T	--	--	--	--	--	--	--
07/29/60	5050				0.00	T	--	0.00	T	0.00	T	0.00	T	--	--	0.03	T	--
07/29/60	5050				--	--	--	--	--	0.00	D	--	--	--	--	--	--	--
09/11/63	5050				0.00	D	--	--	--	0.00	D	0.00	D	--	--	0.52	D	--
08/31/66	5050				0.00	D	--	--	--	0.01	D	0.00	D	--	--	0.10	D	--
08/24/72	5050			64.0F	0.00	D	0.00	D	--	0.01	D	0.01	D	0.00	D	0.15	D	--
	1550			225 7.4						0.08	D	0.00	D					
			41N/11E-05L01 M															
08/04/58	5050			57.0F	--	--	--	--	--	0.03	T	--	--	--	--	--	--	--
			41N/11E-21P01 M															
08/04/58	5050			78.0F	0.00	T	--	0.00	T	0.00	T	0.00	T	--	--	0.00	T	--
08/04/58	5050			78.0F	--	--	--	--	--	--	D	--	--	--	--	--	--	--

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MINOR ELEMENT ANALYSES OF GROUND WATER

DATE TIME	SAMP LAB	DEPTH	DISCH EC	TEMP PH	ARSENIC	BARIUM CADMIUM	CHROM (ALL) CHROM (HEX)	COPPER IRON	LEAD MANGANESE	MERCURY SELENIUM	SILVER ZINC	REM
			A A-23 A-23.E A-23.E1 41N/11E-26802 M	SACRAMENTO HB PITT RIVER HU UPPER PITT RIVER HA CANBY HSA		CONTINUED						
08/04/58 1710	5050 5050			62.0F	--	--	--	0.03 T	--	--	--	
			41N/11E-29H01 M									
08/04/58 1540	5050 5050			65.0F	--	--	--	0.00 T	--	--	--	
			41N/11E-29J01 M									
08/04/58 1620	5050 5050			57.0F	--	--	--	0.03 T	--	--	--	
			42N/09E-23K01 M									
08/05/58 1420	5050 5050			60.0F	--	--	--	0.03 T	--	--	--	
			42N/09E-26J01 M									
08/05/58 1340	5050 5050			56.0F	--	--	--	0.04 T	--	--	--	
			42N/09E-35R01 M									
08/05/58 1240	5050 5050			60.0F	--	--	--	0.04 T	--	--	--	
			42N/09E-36L01 M									
08/05/58 1300	5050 5050			55.0F	--	--	--	0.03 T	--	--	--	
			42N/10E-13G01 M									
08/05/58 0930	5050 5050			82.0F	0.00 T	--	0.00 T	0.00 T	0.00 T	--	--	0.00 T
08/05/58 0945	5050 5050			82.0F	--	--	--	0.00 T	--	--	--	

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MINOR ELEMENT ANALYSES OF GROUND WATER

DATE TIME	SAMP LAB	DEPTH	DISCH EC	TEMP PH	ARSENIC	BARIUM CADMIUM	CHROM (ALL) CHROM (HEX)	COPPER IRON	LEAD MANGANESE	MERCURY SELENIUM	SILVER ZINC	REM
A A-23 A-23.E A-23.E2 39N/12E-02L01 M					SACRAMENTO HB PITT RIVER HU UPPER PITT RIVER HA ALTURAS HSA					CONTINUED		
06/02/58 1040	5050 5000			64.0F	--	--	--	0.02 T	--	--	--	
39N/13E-05D02 M												
06/02/58 1435	5050 9551			59.0F	--	--	--	0.00 T	--	--	--	
39N/13E-06N01 M												
06/02/58 1300	5050 9551			70.0F	--	--	--	0.00 T	--	--	--	
07/29/60 0850	5050 5050			69.0F	--	--	--	0.11 T	--	--	--	
07/29/60 0851	5050 5050			69.0F	0.00 D	--	0.00 D	0.00 D	0.01 D 0.00 D	--	0.69 D	
09/12/63 0920	5050 5050				0.00 D	--	--	0.00 D 0.04 T	0.00 D 0.00 D	--	0.14 D	
39N/13E-07N01 M												
06/02/58 0950	5050 5000			54.0F	--	--	--	0.00 T	--	--	--	
39N/13E-08K01 M												
06/02/58 1235	5050 5000			59.0F	--	--	--	0.00 T	--	--	--	
39N/13E-09D01 M												
06/02/58 1350	5050 5000			56.0F	--	--	--	0.00 T	--	--	--	

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MINOR ELEMENT ANALYSES OF GROUND WATER

DATE TIME	SAMP LAB	DEPTH	DISCH EC	TEMP PH	CONSTITUENTS IN MILLIGRAMS PER LITER										REM
					ARSENIC	BARIUM CADMIUM	CHROM (ALL) CHROM (HEX)	COPPER IRON	LEAD MANGANESE	MERCURY SELENIUM	SILVER ZINC				
A A-23 A-23.E A-23.E2 39N/13E-18A01 M		SACRAMENTO HB PITT RIVER HU UPPER PITT RIVER HA ALTURAS HSA										CONTINUED			
06/02/58 0915	5050 5000			58.0F	--	--	--	0.00	T	--	--	--	--		
40N/12E-11F01 M															
06/03/58 0845	5050 5000			66.0F	--	--	--	0.00	T	--	--	--	--		
07/29/60 0930	5050 5050			69.0F	--	--	--	0.19	T	--	--	--	--		
07/29/60 0931	5050 5050			69.0F	0.00	D	--	0.00	D	0.00	D	--	0.00	D	
127 09/12/63 0845	5050 5050				0.00	D	--	0.01	T	0.00	D	--	0.00	D	
40N/12E-25J01 M															
06/03/58 0745	5050 9551			58.0F	--	--	--	0.00	T	--	--	--	--		
07/29/60 0915	5050 5050			69.0F	--	--	--	0.00	T	--	--	--	--		
07/29/60 0915	5050 5050			69.0F	0.00	T	--	0.00	T	0.00	T	--	0.08	T	
07/29/60 0916	5050 5050			69.0F	0.00	D	--	0.00	D	0.00	D	--	0.08	D	
07/29/60 0930	5050 5050			69.0F	--	--	--	0.00	D	--	--	--	--		
09/12/63 0900	5050 5050				0.00	D	--	0.03	T	0.00	D	--	0.14	D	
08/07/67 1500	5050				0.00	D	--	--	--	--	--	--	--		

MINOR ELEMENT ANALYSES OF GROUND WATER

DATE TIME	SAMP LAB	DEPTH	DISCH EC	TEMP PH	ARSENIC	BARIUM CADMIUM	CHROM (ALL) CHROM (HEX)	COPPER IRON	LEAD MANGANESE	MERCURY SELENIUM	SILVER ZINC	REM
A A-23 A-23.E A-23.E2 40N/12E-26A01 M					SACRAMENTO HB PITT RIVER HU UPPER PITT RIVER HA ALTURAS HSA					CONTINUED		
06/03/58 0805	5050 5000			56.0F	--	--	--	0.00 T	--	--	--	
40N/13E-31E01 M												
06/02/58 1515	5050 5000			110.0F	0.00 T	--	0.00 T	0.00 T	0.00 T	--	0.00 T	
06/02/58 1530	5050 5000			110.0F	--	--	--	0.00 D	--	--	--	
41N/12E-02N01 M												
06/03/58 0940	5050 5000			57.0F	--	--	--	0.03 T	--	--	--	
41N/12E-15H01 M												
06/03/58 0910	5050 5000			64.0F	--	--	--	0.00 T	--	--	--	
07/29/60 1000	5050 5050			74.0F	--	--	--	0.00 T	--	--	--	
07/29/60 1001	5050 5050			74.0F	0.00 D	--	0.00 D	0.00 D	0.00 D	--	0.09 D	
07/29/60 1015	5050 5000			74.0F	--	--	--	0.00 T	--	--	--	
09/12/63 0830	5050 5050				0.01 D	--	--	0.00 D	0.00 D	--	0.71 D	
08/07/67 1430	5050			71.5F	0.00 D	--	--	--	--	--	--	
41N/12E-15Q01 M												
08/18/82 1405	5050 5050		215	77.0F 7.7	0.00 T	--	--	--	--	--	--	

MINOR ELEMENT ANALYSES OF GROUND WATER

DATE TIME	SAMP LAB	DEPTH	DISCH EC	TEMP PH	ARSENIC	CONSTITUENTS BARIUM CADMIUM	IN HILLIGRAMS CHROM (ALL) CHROM (HEX)	PER LITER COPPER IRON	LEAD MANGANESE	MERCURY SELENIUM	SILVER ZINC	REM
	A A-23 A-23.E A-23.E2 41N/13E-05B02 M					SACRAMENTO HB PITT RIVER HU UPPER PITT RIVER HA ALTURAS HSA						
												CONTINUED
06/03/58 1045	5050 5000			55.0F	--	--	--	0.29 T	--	--	--	
												41N/13E-18P01 M
06/05/58 0950	5050 5000			60.0F	--	--	--	0.01 T	--	--	--	
07/29/60 0800	5050 5050			67.0F	--	--	--	0.22 T	--	--	--	
07/29/60 0801	5050 5050			67.0F	0.00 D	--	0.00 D	0.00 D	0.00 D	--	0.07 D	
129 09/10/63 1205	5050 5050				0.01 D	--	--	0.00 D 0.38 T	0.01 D 0.00 D	--	-- 0.42 D	
08/29/66 1430	5050				0.02 D	--	--	0.26 T	0.00 D	--	--	
08/07/67 1410	5050			59.0F	0.01 D	--	--	--	--	--	--	
07/14/69 1420	5050		1010	59.0F 7.0	--	--	--	--	--	--	--	
08/24/78 1219	5050 5050		675	61.0F 7.2	0.01 T	--	--	0.03 T 0.01 T	0.00 T 0.09 T	--	-- 0.03 T	
												41N/13E-30L01 M
06/02/58 1540	5050 5000			56.0F	--	--	--	0.30 T	--	--	--	
												42N/11E-24A01 M
06/04/58 1035	5050 5000			58 F	--	--	--	0.04 T	--	--	--	
07/29/60 0721	5050 5050			57.0F	--	--	--	0.26 T	--	--	--	
07/29/60 0722	5050 5050			57.0F	0.00 D	--	0.01 D	0.00 D 0.01 D	0.00 D 0.00 D	--	-- 0.26 D	

MINOR ELEMENT ANALYSES OF GROUND WATER

DATE TIME	SAMP LAB	DEPTH	DISCH EC	TEMP PH	ARSENIC	BARIUM CADMIUM	CHROM (ALL) CHROM (HEX)	COPPER IRON	LEAD MANGANESE	MERCURY SELENIUM	SILVER ZINC	REM
	A A-23 A-23.E A-23.E2 42N/11E-24A01 M					SACRAMENTO HB PITT RIVER HU UPPER PITT RIVER HA ALTURAS HSA						
									CONTINUED			
09/11/63 1245	5050 5050				0.00 D	-- --	-- --	0.01 D 0.42 T	0.01 D 0.00 D	-- --	-- 3.8 D	
	42N/12E-01R01 M											
06/04/58 1320	5050 5000			59.0F	--	-- --	-- --	-- 0.00 T	-- --	-- --	-- --	
	42N/12E-02A01 M											
06/04/58 1155	5050 5000			66.0F	--	-- --	-- --	-- 0.00 T	-- --	-- --	-- --	
	42N/12E-02H01 M											
07/18/56 0930	5050 5000				--	-- --	-- --	-- --	-- --	-- --	-- --	
	42N/12E-02R01 M											
08/16/82 1545	5050 5050			63.0F 7.8	0.00 T	-- --	-- --	-- --	-- --	-- --	-- --	
	42N/12E-07H01 M											
06/04/58 0955	5050 5000			57.0F	--	-- --	-- --	-- 0.00 T	-- --	-- --	-- --	
	42N/12E-08E01 M											
06/04/58 0920	5050 5000			62.0F	--	-- --	-- --	-- 0.00 T	-- --	-- --	-- --	
	42N/12E-09F01 M											
06/04/58 0855	5050 5000			62.0F	--	-- --	-- --	-- 0.00 T	-- --	-- --	-- --	

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MINOR ELEMENT ANALYSES OF GROUND WATER

DATE TIME	SAMP LAB	DEPTH	DISCH EC	TEMP PH	ARSENIC	BARIUM CADMIUM	CHROM (ALL) CHROM (HEX)	COPPER IRON	LEAD MANGANESE	MERCURY SELENIUM	SILVER ZINC	REM
A A-23 A-23.E A-23.E2 42N/13E-05M01 M					SACRAMENTO HB PITT RIVER HU UPPER PITT RIVER HA ALTURAS HSA					CONTINUED		
06/04/58 1250	5050 5000			62.0F	--	--	--	0.00 T	--	--	--	--
42N/13E-06601 M												
06/04/58 1220	5050 5000			64.0F	--	--	--	0.00 T	--	--	--	--
42N/13E-17D01 M												
06/03/58 1400	5050 5000			57.0F	--	--	--	0.00 T	--	--	--	--
42N/13E-22D01 M												
06/04/58 1910	5050 5000			58.0F	--	--	--	0.00 T	--	--	--	--
42N/13E-28K01 M												
06/05/58 0735	5050 5000			59.0F	--	--	--	0.01 T	--	--	--	--
42N/13E-30C01 M												
06/03/58 1230	5050 5000			65.0F	--	--	--	0.00 T	--	--	--	--
42N/13E-31G01 M												
06/03/58 1110	5050 5000			59.0F	--	--	--	0.19 T	--	--	--	--
08/22/59 1610	5050 5050			62.0F	--	--	--	--	--	--	--	--
07/29/60 0715	5050 5050			63.0F	--	--	--	0.29 T	--	--	--	--
07/29/60 0716	5050 5050			63.0F	0.00 D	--	0.00 D	0.00 D 0.11 D	0.01 D 0.00 D	--	-- 0.18	-- D
09/10/63 1230	5050 5050				0.00 D	--	--	0.00 D 0.10 T	0.00 D 0.00 D	--	-- 0.09	-- D

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MINOR ELEMENT ANALYSES OF GROUND WATER

DATE TIME	SAMP LAB	DEPTH	DISCH EC	TEMP PH	CONSTITUENTS IN MILLIGRAMS PER LITER										REMARKS		
					ARSENIC	BARIUM CADMIUM	CHROM (ALL) CHROM (HEX)	COPPER IRON	LEAD MANGANESE	MERCURY SELENIUM	SILVER ZINC						
		A A-23 A-23.E A-23.E2 42N/13E-32G01 M		SACRAMENTO HB PITT RIVER HU UPPER PITT RIVER HA ALTURAS HSA										CONTINUED			
06/03/58	5050			54.0F													
1130	5000							2.30	T								
07/29/60	5050			59.0F													
0730	5050							0.18	T								
07/29/60	5050			59.0F				0.00	D	0.01	D						
0731	5050				0.00	D		0.00	D	0.01	D				0.00	D	
09/10/63	5050							0.00	D	0.00	D						
1240	5090				0.01	D			T	0.00	D				0.01	D	
08/29/66	5050									0.00	D						
1600					0.01	D											
07/14/69	5050			57.0F													
1310			378	7.4	0.00	D											
		42N/13E-34K01 M															
06/05/58	5050			56.0F													
0940	5000							0.00	T								
		44N/13E-36A01 M															
07/29/60	5050																
0720	5090							0.09	T								
07/29/60	5050							0.00	D	0.00	D						
0721	5050				0.00	D		0.00	D	0.03	D				0.08	D	
08/08/67	5050			60.0F													
0800					0.00	D											
		44N/14E-07K01 M															
07/29/60	5050			56.0F													
0745	5050							0.03	T								
07/29/60	5050			56.0F				0.00	D	0.01	D						
0746	5050				0.00	D		0.00	D	0.00	D				0.00	D	
08/29/62	5050							0.00	D	0.00	D						
1145	5050				0.00	D			T	0.00	D				0.14	D	

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MINDR ELEMENT ANALYSES OF GROUND WATER

DATE TIME	SAMP LAB DEPTH	DISCH EC	TEMP PH	ARSENIC	CONSTITUENTS IN MILLIGRAMS PER LITER				LEAD MANGANESE	MERCURY SELENIUM	SILVER ZINC	REM	
*	*	*	*	*	*	*	*	*	*	*	*	*	*
	A A-23 A-23.E A-23.E2 44N/14E-07K01 M				SACRAMENTO HB PITT RIVER HU UPPER PITT RIVER HA ALTURAS HSA								
			54.0F										
08/08/67 0830				0.01 D	--	--	--	--	--	--	--		

CONTINUED

SUPPLEMENTAL MINOR ELEMENT ANALYSES OF GROUND WATER

DATE TIME	SAMP LAB	DEPTH	DISCH EC	TEMP PH	ALUMINUM	ANTIMONY BERYLLIUM	BISMUTH COBALT	GALLIUM GERMANIUM	LITHIUM MOLYBDENUM	NICKEL STRONTIUM	TITANIUM VANADIUM	REM
	A											
	A-23											
	A-23.E											
	A-23.E1											
	40N/11E-02J01	M										
07/29/60	5050											
0916	5050				0.0	D	--	--	--	--	--	
	41N/10E-02N02	M										
08/28/62	5050											
1100	5050				0.00	D	--	--	--	--	--	
	41N/11E-02J01	M										
07/29/60	5050											
0915	5050				0.0	T	--	--	--	--	--	
09/11/63	5050											
1300	5050				0.04	D	--	--	--	--	--	
08/31/66	5050											
1250	5050		235		0.01	D	--	--	--	--	--	
	41N/11E-21P01	M										
08/04/58	5050			70.0F								
1510	5050				0.09	T	--	--	--	--	--	
	42N/10E-29H01	M										
07/29/60	5050											
0018	5050				0.0	D	--	--	--	--	--	
09/11/63	5050											
1330	5050				0.08	D	--	--	--	--	--	
	42N/11E-09K01	M										
07/29/60	5050			93.0F								
0748	5050				0.0	D	--	--	--	--	--	

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SUPPLEMENTAL MINOR ELEMENT ANALYSES OF GROUND WATER

DATE TIME	SAMP LAB	DEPTH	DISCH EC	TEMP PH	ALUMINUM	ANTIMONY BERYLLIUM	BISMUTH COBALT	GALLIUM GERMANIUM	LITHIUM MOLYBDENUM	NICKEL STRONTIUM	TITANIUM VANADIUM	REM
<p>A A-23 SACRAMENTO HB A-23.E PITT RIVER HU A-23.E1 UPPER PITT RIVER HA 42N/11E-19E01 M CANBY HSA</p> <p>CONTINUED</p>												
07/29/60	5050											
08 04	5050				0.0 D	--	--	--	--	--	--	
09/11/63	5050											
1350	5050				0.06 D	--	--	--	--	--	--	
<p>A-23.E2 ALTURAS HSA 39N/13E-06N01 M</p>												
07/29/60	5050			69.0F								
0851	5050				0.01 D	--	--	--	--	--	--	
09/12/63	5050											
0920	5050				0.19 D	--	--	--	--	--	--	
<p>40H/12E-11F01 M</p>												
07/29/60	5050			69.0F								
0931	5050				0.00 D	--	--	--	--	--	--	
09/12/63	5050											
0845	5050				0.07 D	--	--	--	--	--	--	
<p>40N/12E-25J01 M</p>												
07/29/60	5050			69.0F								
0915	5050				0.0 T	--	--	--	--	--	--	
07/29/60	5050			69.0F								
0916	5050				0.0 D	--	--	--	--	--	--	
09/12/63	5050											
0900	5050				0.01 D	--	--	--	--	--	--	
<p>40N/13E-31E01 M</p>												
06/02/58	5050			110.0F								
1515	5000				0.08 T	--	--	--	--	--	--	

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SUPPLEMENTAL MINOR ELEMENT ANALYSES OF GROUND WATER

DATE TIME	SAMP LAB	DEPTH	DISCH EC	TEMP PH	ALUMINUM	ANTIMONY BERYLLIUM	BISMUTH COBALT	GALLIUM GERMANIUM	LITHIUM MOLYBDENUM	NICKEL STRONTIUM	TITANIUM VANADIUM	REM	
	A A-23 A-23.E A-23.E2 41N/12E-15H01 M												
						SACRAMENTO HB PITT RIVER HU UPPER PITT RIVER HA ALTURAS HSA							
						CONTINUED							
07/29/60 1000	5050 5050			74.0F	0.00 T	--	--	--	--	--	--	--	
07/29/60 1001	5050 5050			74.0F	0.0 D	--	--	--	--	--	--	--	
09/12/63 0830	5050 5050				0.06 D	--	--	--	--	--	--	--	
						41N/13E-18P01 M							
07/29/60 0801	5050 5050			67.0F	0.0 D	--	--	--	--	--	--	--	
09/10/63 1205	5050 5050				0.15 D	--	--	--	--	--	--	--	
08/24/78 1210	5050 5050		675	61.0F 7.2	0.0 T	--	--	--	--	--	--	--	
						42N/11E-24A01 M							
07/29/60 0722	5050 5050			57.0F	0.01 D	--	--	--	--	--	--	--	
09/11/63 1245	5050 5050				0.09 D	--	--	--	--	--	--	--	
						42N/12E-11J01 M							
07/24/68 1405	5050 5050		395	64.0F 7.4	0.04 D	--	--	--	--	--	--	--	
						42N/12E-11Q01 M							
07/29/60 0945	5050 5050				0.00 D	--	--	--	--	--	--	--	
09/10/63 1410	5050 5050				0.05 D	--	--	--	--	--	--	--	

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